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The Orbital Flight Test Program

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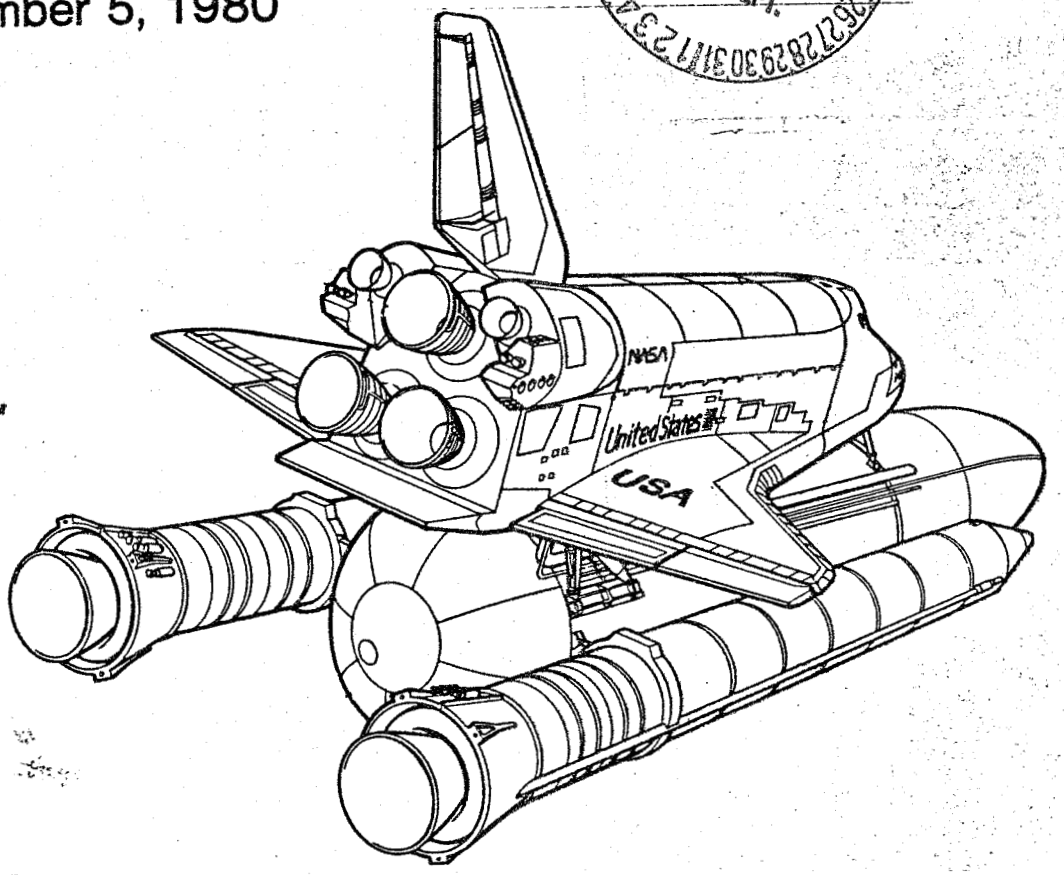

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STS News Briefing:

THE ORBITAL FLIGHT TEST PROGRAM

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P R O C E E D I N G S

VOICE: Huntsville, Alabama, Kennedy Space Center, Washington; DFRC and JPL. We have our fifth in a series of NASA briefings on the Space Transportation System. With us today is Donald K. Slayton, "Deke" Slayton, astronaut on the ASTP flight in 1975. With him is Ed Whitacre and Larry Keyser, of the Mission Operations Office at the Johnson Space Center.

We want to apologize; probably at the other centers we are missing some pages of Mr. Keyser's presentation. However, these will be shipped out today and will be at the various locations tomorrow.

The next briefing in this series will be at the Kennedy Space Center, and this briefing is dependent upon transfer of the Orbiter Columbia to the vehicle assembly building. NASA will announce the date of this briefing when we are firm in moving of the vehicle. So without further ado, we will turn it over to Mr. Donald K. Slayton.

MR. SLAYTON: Okay. We are going to talk to you today primarily about the Orbiter Flight Test Program, how it is constructed, the first four flights. I am just going to give an introduction and these guys who work this thing daily in great detail will give you the details. At the conclusion -- we are going to try to keep it informal; however, the logistics don't allow you to ask question in real time, so make notes and we will try to answer everybody's questions when we get to the end.

There is one other guy I would like to introduce before we start who is not up here, and that is Al Bishop, who is these guys' boss. He is the one who is responsible for the overall mission planning for the Shuttle Program. He will be available to answer questions at the end as required.

As an introduction let me just tell you where we are today with the Orbiter. We have a daily meeting at noon everyday where we tie everybody in by telephone coast to coast and see how it went during the last 24 hours and what the problems are for the next 24 to 48.

Right now the external tank and the SRBs are in the process of being mated. We are in a process of doing a full test this afternoon or tomorrow, putting a pre-load into the space between those two; and that is due to be completed on second shift tomorrow. So at that point they will be ready to accept the Orbiter.

We have an Orbiter Customer Acceptance Review at Downey scheduled Thursday and Friday of this week, and followed by on Thursday of next week, on the 13th, the pre-rollout review to decide whether we are ready to take the Orbiter out of the OPF and out to the pad for mating.

The engines are going to be installed over the weekend; they are ready to go right now, so everything is looking good they are ready to go right now, so everything is looking good right this minute for rollout on the 23rd. On everybody's favorite subject, the tile, gap fillers and so forth, as of today we have 520 open cavities, another 28 potential threats. There is another list of about 500 approximately that are possible threats, but we are reasonably confident that we are going to work those off in the papermill system and not mess with them.

We have 600 trailing edge-gap fillers to go, about 150 leading-edge and about a thousand Ames. That all fits into the current flow, so we are confident that we are going to make the 23rd.

(Slide)

MR. SLAYTON: Let's press on with the briefing. Okay. We have some vugraphs here; let's jump to the first one. These are not numbered, so for everybody on the loop, we may have a little problem with your keeping in sync with us. The first one I have here is what the Orbiter Flight Test Program is all about.

OFT is a four-orbit flight test program. We launch out of Cape Kennedy on all four of these flights, and we land at Edwards Air Force Base on all four of them; our Master Plan. And our objective is to get an early operational capability of the Space Transportation System.

We did start in with more flight than this in the program at one time, and we keep whittling it back. The objective, of course, of any space flight program is to confirm that we did have a good design, verify the design and verify our performance.

And a major consideration, of course, when you start building a flight test program, you need to understand what can be and what has been done in the ground test and analysis; you do want to get a reasonable incremental buildup in risk. In my opinion, about 90 percent of your risk in a total program comes with a first flight, and the rest of it you can spread across the other three. But we do make an effort to build into this thing incrementally the best we can.

The problem we have as usual with space flight is that once you have gotten that far off the pad, the best thing you can do -- the best place you can go from there is into orbit. There is no nice in-between milestone. You have to bite it all in one chunk.

Of course, availability of hardware and software decides how fast you can build into the program. We do have some mods that are planned as we press on through, we change software between the first and second flights and there will be changes subsequent to that.

Your turnaround operations, and detail to that, of course, is another thing we have to consider. And we are trying to the best of our ability during the Flight Test Program to demonstrate some payload capabilities. That is what the Shuttle is all about, is payload.

But on the other hand, we can't let payload drive the basic program. The basic test program is driven by test requirements that you are going to hear a lot more about; and we consider the payloads as secondary.

(Slide)

MR. SLAYTON: Okay. Next vugraph: Approach you take to the Flight Test Program, of course, is a progressive expansion of the flight envelope. And we are trying to maximize our capabilities in four flights. As I said, the transfer from flight test to operations is not a clean transition. You cannot totally remove all your placards in four flights; we know that. And we will show you later on some areas we know right now that it is going to take at least nine flights to work through them.

So our objective is to accomplish most of what we think can be done in four flights with the recognition that some things will dribble over and the vehicle will be placarded inside the spec values in some areas.

In general, to the best of our knowledge to date, none of that ends up being a constraint to the operational program. As a typical example, high Beta angel thermal requirements don't occur until very far downstream, around the 25th payload. So those kinds of things are not a constraint to us, despite the fact that we couldn't get them done earlier in the program.

(Slide)

Okay. Where we are now in overall status, I have given you a little bit of that already. As far as the Orbiter is concerned, launch facilities are in pretty good shape, ready to accept the vehicles when they get there. As far as Edwards Air Force Base, that is coming along. I think most of you know we are using Northrup Strip; White Sands is an AOA (abort once around) also is an alternate prime landing site. That is coming along okay.

The flight crew is going to be well trained as usual, probably over-trained, and Mission Control Center, those guys have been over there working. Some of you have watched some of that here in the last few weeks, and that is going very well.

We have some long duration sims scheduled, one for December, and then in conjunction with the FRF in February, we will run what we call a Mission Verification Test, which will be a full-up simulation all the way around the network including the recovery site.

So I think we look to be ready to fly ahead of schedule as far as most of the Mission elements are concerned. The only other things are launch commit criteria, which again is in very good shape. We have a little open work to do relative to the FRF because we are in a ground environment mode and running in a plus time, and it can't be done exactly the same as a flight; so there is some work yet to be done there.

(Slide)

MR. SLAYTON: The major test drivers to the Flight Test Program, this particular one of course, I think are obvious to everyone. I will go over them real quick. The ascent envelope and ascent performance, obviously a driver we want to build up our "Q" or loading on the vehicle in progressive steps and make it as benign as possible on the first flight, and eventually get up to our spec value.

Entry Aero and Flight Control, same issue here. We want to work into that very gradually. As a matter of fact, we do almost no intentional aero flight test on first flight. We don't want to disturb anything; we want to fly that entry corridor as benign as we know how. So we will worry about getting aero test points later on in the program.

Thermal protection on entry is the same kind of thin, as well as the on orbit thermal, and any other driver, of course, that is operational performance of subsystems.

So, with those preliminary comments, I am going to turn it over to Ed, and he is going to talk the overall program; and then Larry is going to talk STS-1 specifically.

VOICE: If I may for the record, for Mr. Whitacre, he is the STS Four Mission Staff Engineer.

MR. WHITACRE: Okay. What I am going to do is bore you with a lot of slides and details of the Flight Test Program, the specific things we are trying to accomplish.

(Slide)

The first thing I would like to point out about the Flight Test Program is that most of the charts I am going to be talking about have to do with what we do in flight. There is another aspect to the OFT Program that is equally important, and in some respects even more important; and that is that a Flight Test Program brings together for the first time in reality all of the elements of the operational system: The ground processing, the SRB refurbishment, the ET activities, ferry operations, and all of the Control Center Operations in your various ground tracking stations, communications networks, and so on. All these factors are essential to the overall Shuttle operational capability, and they will all be verified for the first time we would bring

together an OFT Program.

(Slide)

MR. WHITACRE: Another aspect of this which is very important also, is that flight testing of the vehicle is just a concluding effort in a long process of verification of the vehicle's capabilities.

We have had many years of testing of subsystems components, subsystems themselves and combined systems in ground vacuum testing, in the ALT (approach and landing tests) program and in a whole wide variety of ground test facilities.

And the flight test is not only a verification of the real world conditions for these subsystems, but it brings them all together in an overall vehicle for the first time other than those things which we did during the short ALT flights.

And when we go into OFT, then, we pick up some additional things that we can't do very well on the ground in terms of a system as complex as the Shuttle. These things like totally integrated man/machine software interactions, full scale aerodynamic effects, zero G effects, the real world thermal vacuum effects, space, and so on.

(Slide)

MR. WHITACRE: The way we get to the Flight Test Program, just briefly, let me talk about the documentation for just a moment. We go to the subsystems people who are the real experts on the various complements of the Orbiter, and we ask them essentially, what is your status in terms of verification of the capabilities of the various components of the vehicle and what still needs to be done when we put all of these things together into an actual flight vehicle and put it into orbit.

We take those requirements and we combine them with overall program objectives. We document the first of these in what we call the Flight Test Requirements Documents, which lists all of the flight test requirements for individual subsystems, and we have another document we call the Master Flight Test Assignments Document, which provides the basic program objectives and assigns the flight test requirements themselves to specific flights. And then we write another document which is called the Flight Requirements Document, and that is written for each individual flight; and it is a sort of an Ed MacMahon document, which tells you everything you ever wanted to know about that particular flight in terms of what we are trying to accomplish.

This document in turn is used as the guideline in coming up with the long, long list of operational documents which define things like the flight crew file, crew activity plan, flight rules. And there are literally dozens and dozens of documents

which detail all of the specific aspects of what is going to occur in flight.

(Slide)

MR. WHITACRE: Then we get on with the job of planning an OFT Program. I will say a couple of words about the chart on your left. This is really just a memory jogger for me, but the thing is it just gives you an idea of the kinds of things which go into planning for any flight whether it is OFT or otherwise, and the same things that you see listed up here are the things that you really end up verifying by performing the flight.

These are the things you are concerned about when you plan it, the things that you verify when you fly it. So that when you get into an operational period, you have enough of a data base that you no longer have to be greatly concerned about these things in your planning.

(Slide)

MR. WHITACRE: The chart on the right, which is chart number five, list some of the parameters of the four OFT Flights, which gives you a pretty good overall perspective of what we are trying to accomplish here in terms of the way we are going to fly the flight.

The thing to really notice is that in some of the critical areas we are making gradual progressions from a nice easy situation for the first flight to, let us say a more stressful situation on OFT-4.

I might mention a few of those. One thing we are doing right here early is the inclination. We are sticking with the 40.3 degree inclination for the first two flights, and the basic reason we are doing that is because of concern with regards to overspeed on the main engines; if we should have an overspeed and we went to 38 degrees, for example, we have a possibility of some impact of ET fragments in the Australian Continent area. So we stick with 40.3 degrees until we get a better feel for actual vehicle performance.

The F-Max Q. Now you can see that we gradually step through that to a 680 psf (pounds per square foot) on flight four. We start off on Flight One at 580 psf, and we do that to hold down the loads on the vehicle and then gradually build that up until flight four, so again, we are building a data base as we go.

Alpha Profile, this is entry angle of attack. And what we are doing here is we are flying three flight to 40 degrees Alpha Profile, which is not the presently planned operational Alpha Profile; 38/28 is the planned operational Alpha Profile, and the reason we are sticking with 40 degrees is it imposes a much lower total heat load on the vehicle. It allows us to enter with less

stress on the Thermal Protection System.

Then on flight four, we go to the lower Alpha Profile and get higher heat loads. I will show you considerably more detail on all of these things later on.

The second flight we add to that the OSTA Pallet, which is about another 5600 pounds, and it is a scientific instrument pallet. On the third flight we have the PDRS (payload deployment and retrieval system) test article, or by another name, the PSTA (payload system test article), which is a test article designed specifically to verify performance of the PDRS system, the are that is used for taking payloads in and out of the payload bay.

And on flight four, we have the OSS-1 payload, a little package that is called the Get-away Special. You have probably read a lot about the get-away special concept, which are small payload carrying capability in a canister that anybody can sign up for. Well, we are going to try to fly the first one of those as a test article on the fourth flight, of OFT.

(Slide)

MR. WHITACRE: In looking at an overview of the overall OFT, the major test objectives, the real thing to get out of this slide is that there are a lot of major test objectives and that there are a fair amount of them that are not going to get done entirely on OFT. It is misleading to think that this is all the tests, and the things that occur in flight one for any one of these line items it is not necessarily the same thing that occurs on flight two, three or four.

They are different tests. This is just an overall perspective of the general areas. As you note down here at the bottom, there are actually some 1,180 tests identified for the OFT Program.

To support that testing we have approximately 3,500 sensors on the vehicle, DFI sensors. I mentioned the DFI package. That is what it is all about, getting a large data base on the way the vehicle really flies.

(Slide)

MR. WHITACRE: Now, I have broken this down further into the ascent activity; and again you can see as we go into these things that some of them don't get done in OFT. But on this particular thing, the main thing to point out is during ascent, most of what we are doing we don't perturb the vehicle.

There are only a few tests during ascent where we actually do anything at all to the vehicle in terms of a special crew activity, or a special input to the vehicle. Basically, we let it fly, and some of the things I mentioned before, such as Max-Q

-- the ascent trajectory itself is varied. We have different SRB staging altitudes. Those things all affect the way the vehicle flies; but basically as far as doing something special, we don't don that except in the flutter buffet area, and we have a test here where we do some UHF tests through the SRB plume.

(Slide)

MR. WHITACRE: There are some really major aspects to ascent phase aside from just getting into orbit. One of them is ascent heating. We have done a great deal of ground test in wind tunnels, but there are realistic limits to what you can accomplish in wind tunnels when you are talking about a vehicle the size of the Orbiter, especially when you are talking about the kinds of velocities we are talking about.

We are talking about, the things we are looking at are flow field dynamics, localized heating. One thing that is a concern in some areas is the interaction of various shock waves off the vehicle and the possibility of localized heating in certain areas.

This is something you can subscale tests on in wind tunnels but until you get to the real thing, you still have some areas of concern. We are concerned about ET; when I say "concern" by the way, I don't mean that we are greatly worried about it. I mean that the engineers feel that we have an incomplete data base and we need more data to see how it is really operating and what kinds of conditions really exist.

We are talking about ET heating at high altitudes. You are probably aware that the ET is not recovered; it does break up on entry; and one of the things which affects where it breaks is the heating that occurs during the launch period. So we would like to get a much better data base that is possible through wind tunnel tests.

We are looking at the adequacy of the TPS design or margin, if you will; and we are looking at things that will help us later on to design a better vehicle as we get on to building Orbiters 103 and 104.

I mentioned already that we do things -- I said that we keep our hands off in flight. That is true; but preflight we do things in planning in variations in trajectory lofting, changes in MECO (main engine cutoff) altitude, SRB separation and different throttling profile changes. All of these things affect the load induced on the vehicle.

(Slide)

MR. WHITACRE: Another very important aspect -- and by the way, 102 doesn't have a nose probe on it like I put on this one. I have the wrong picture. But another major aspect of ascent is the loads that are incurred on the vehicle. We have a lot of test

data again, on what kinds of aerodynamic loads we are going to get. But it is, again, very difficult to do this on the ground and find out what the real effects of the combined vehicle actually performing in real launch are.

Here we are talking about the interaction between the ET, SRB, and Orbiter in a combined vehicle, the loads which are induced on the connect struts between the vehicle, the dynamic responses of the vehicle, things like aerodynamic input, vehicle slushing, engine thrust vector control.

There are quite a variety of things happening all at once; all of these are making various inputs to the vehicle, and we are trying to get a good data base on that.

On the Orbiter internal loads, we are looking at things like strut loads dissipation, wing loading, loads on the vertical tail and the dynamics of payloads themselves. We know that some of the post-OFT period payloads are rather dynamic in terms of a very flexible payload, and we want to get better data base of what is happening in the payload bay when we have payload.

(Slide)

MR. WHITACRE: A third area which has been around for a long time and is king of a gremlin that sticks with all of our rocketry is the item called Pogo, which is a very dynamic interaction between the total propellant system in the engine and results in engine instability, if you will, or dynamic variations in the engine performance, which leads to longitudinal oscillations in the vehicle, which leads to structural loading in the vehicle, which leads to nastry problems if it really happens.

In the case of the Shuttle, we have designed in the system Pogo suppressors, and it has been tested extensively, but this is such a dynamic problem and is so difficult to analyze analytically that the only real way that you ever find out that you've got a good safe margin on Pogo is you go out and fly it.

Now we think from all of the tests, from all of the analysis that has been done we have a safe margin in terms of Pogo. But the real proof of the pudding so to speak, is that we get out and fly the total vehicle and show that the Pogo suppressors work and there is no dynamic engine instability in the engine operation.

(Slide)

MR. WHITACRE: I keep commenting on one thing here and I think it is a very important point. In a large number of areas, the real thing that we are doing is we are putting together a very complex system, a very complex combination of systems, for which there is no practical way to do ground testing.

It is not entirely that you can't do ground testing on some

of these things; it is just that you already have adequate margin of safety in your analysis and testing that you can do, and it is not cost effective to try to do very, very complicated ground testing where you try to simulate all kinds of dynamic conditions at the same time. It is much more effective and it is the real thing when you get out there and fly it (inaudible).

Another thing that is very important to the payloads people in terms of the Orbiter is what we call the environment characterization, which is what is really happening in the payload bay, what kind of noise levels do we have in there, what kind of particulates and matter do we have floating around, what kind of outgassing occurs, vehicle flexing, and so on.

We have an instrumented payload bay, we have instruments on the payloads we are carrying during OFT. We have microphones, strain gages, and so on, on OSTA. We have them on the IECM, we have them on the Orbiter, we have them on the OSS payload. And the reasons we have on the payloads themselves is so we can not only measure the inputs the vehicle creates, but we can also measure the responses that the payloads themselves do (inaudible).

For example, on the outgassing and free particulates, which obviously you want to minimize particles floating around in the vehicle, so we have measurements on the IECM to measure not only what is happening during ascent, but we go on into orbit this way, and we continue the same series of tests in orbit.

(Slide)

MR. WHITACRE: We are down to chart number 12, for those of you on the loop. We really continue right on into orbit with the same kinds of things that we are testing on ascent, except that we are doing a different kind of testing now.

The outgassing that we are looking for in orbit, for example, contamination monitoring, we are looking at outgassing that is caused by space vacuum environment and by thermal heating from the Sun. Whereas during ascent, we are looking at outgassing that is basically caused by (inaudible).

In ascent we are getting a lot of particles shook loose, and despite any efforts that anybody can ever make on putting a payload into a payload bay on loading the vehicle as far as cleaning it is concerned, you can't get everything out, and there is going to be pre-particulate matter during ascent. This material is shook loose and while you are concerned about where it lodges on the payload, then in orbit you are concerned about the fact that the particulates now are loose and they float around and they reflect sunlight like nice little stars, and they also affect the intent of certain scientific payloads to gather data.

The same is true of outgassing. On orbit test we are very interested in our thermal control systems and our environmental

control systems.

(Slide)

MR. WHITACRE: One of the things I just mentioned is the thermal control system. I am just going to touch on some of the major things we are doing on orbit. As I said, the difference in orbit and ascent is the duration in which you can do the testing.

Our thermal control system of the vehicle, and by the way, let me just mention two or three points about the thermal control system. It is composed primarily of the blanket layering over the vehicle to protect it against heating and loss of heat, both, on the areas of the vehicle.

A series of heaters that are located at various places throughout the vehicle as part of the active control system, a series of thermostats and sensors which are located also throughout the vehicle which are used to provide crew and ground data on the performance of the systems, and to also provide control to these active thermal control systems.

Now, we are pretty sure that we have analyzed this system pretty well, but in fact, any system of this complexity you have things such as heat shorts, where there is a compression of your thermal blankets, for example.

You have a certain planned heat transfer characteristic between two mated parts and you find out that one or the other of the surfaces is contaminated. The parts are mated all right and you have analyzed one heat transfer rate and found out that in fact you have a different heat transfer rate due to any kind of a variety of things -- the parts aren't as tight together as you thought. They are not as flat as far as the contact surfaces as you analyzed and may have surface contamination due to somebody's thumb print. There is a whole wide variety of things that you can't quite get your "handle" on when you do analysis.

We do a long series of tests on orbit to verify that these systems really do work as planned. These thermal tests, I show you here the kinds of things that we are doing.

PTC is passive thermal control; that basically is the rolling attitude of the vehicle; the vehicle is slowly rolling over with tespec to the Sun, so that you average out your heating and cooling on different parts of the vehicle.

And this vehicle can point just about any way you want it to in space. We haven't taught it to dance yet, but it can do just about anything else. When you get into these attitude holds you have a situation where you are in the -- attitude hold where one part of the vehicle is pointed toward the Sun, one part of the vehicle is pointed toward deep space, and other parts of the vehicle are alternately viewing space and the Earth's albedo.

So you have different conditions depending upon the attitude you set up for the vehicle. We hold these attitudes for various time periods on orbit, depending on the particular objective of the particular thermal test.

Some of the things that are happening when you do these thermal tests is you can get in things like the cold payload attachments. You know, the payloads themselves are held in by tie-down mechanism.

The temperatures of the tie-down mechanism affect the sliding coefficient of friction between the payload trunions and the Orbiter. The sliding coefficient of friction affects the loads that are induced both in the Orbiter and on payload, and the loads that are induced on the payloads obviously affect either future design or the performance of the payload itself. So these things kind of have a "snowball" effect as far as the kinds of things you are doing and the kinds of results you get.

And we are also doing things here like firing the RCS (reaction control system) engines while we have the certain thermal attitudes in order to get maximum heating back through the structure to see what long duration firings do as far as heat -- back through the structure.

And we are doing other tests on the payload bay doors. Would you go to the next slide, please. Oh, I am sorry ---these will go real quick.

(Slide)

MR. WHITACRE: This just gives you an example of the different attitudes I was talking about with respect to the Sun and inertial state. We will just kind of skip over those and you can look at them at your leisure.

But as I said, the vehicle can fly a variety of attitudes and each one of these attitudes has a totally different input to the vehicle. Go to the next slides, please.

(Slides)

MR. WHITACRE: We do tests that are part of the thermal tests of the payload bay doors. The payload bay doors are made of a graphite epoxy. The vehicle is made of an aluminum structure. During ascent and entry the doors are closed, but on orbit the doors are open.

As a result, on orbit you have a situation where the vehicle can and does distort in a different manner than the doors do. If you try to close the doors, you have a situation where the doors of the vehicle don't necessarily exactly fit.

We have planned for this in the design of the latch mecha-

nisms for the doors. There has been a lot of testing done to verify that that is the proper design, but is virtually impossible to test a full-scale Orbiter in thermal vacuum conditions and take into account the 1-G effects on Earth and figure out exactly what's really going to happen in Zero-G in space.

So as a part of the thermal test, we do a series of tests opening and closing the doors to make sure that when the day comes that we have to close those doors in a hurry regardless of what attitude we are in, that we can in fact close them and then come back home safely.

(Slide)

MR. WHITACRE: Another series of tests on orbit are those of the PDRS. I already mentioned the manipulator on them. The arm is for putting payloads in and out of the payload bay.

We are doing a series of tests in OFT, first with the arm just as a single arm, unloaded. We go out there and we test all of the control modes, to verify that all of the software works with the real arm, with the real vehicle dynamics that it is supposed to do.

We then take the payload test article on flight three and lift it in and out of the bay, put it in the different positions. The payload, the PDR's test article has several different grapple points on it so you can move it around and get different inertial responses.

One of the things it is designed for is to allow you to simulate the inertias of large payloads. So we do that kind of testing. One thing we can't get done in OFT is the approach-and-capture testing with a payload, and we do that with the German -- we are planning to do that with the German payload called SPAS 01 (Shuttle pallet satellite) presently scheduled for flight six. That schedule, of course, is flexible.

In that test we will be verifying that we can release payloads and pick them back up and approach payloads, and this kind of thing.

(Slide)

MR. WHITACRE: There are other tests -- I am going to skip over these very quickly. We also are verifying the performance of the electrical power system in terms of things like stratification of cryogenics in the tanks, which you get in Zero-G, the effects that has on your boil-off and your feed of cryogenics to the fuel cell; verification of the heat loads into these tanks, and verification of the performance of the electrical system with the actual loads to the vehicle in actual flight.

(Slide)

MR. WHITACRE: The same is true here of the environmental control system where you have all of the radiators, the cold plates, the various cooling systems, the water and ammonia boilers. Well, we won't be verifying the ammonia boilers in orbit but we will be verifying the water boilers, and things, to show that the total complex systems works as planned.

(Slide)

MR. WHITACRE: Okay. We are down to 20 -- I am going to skip over 23, 24 and 25, and just let you look at those on your own. Those are just the further listing of some of the tests that are done in orbit, to verify vehicle performance. Would you go on down to 26, please.

(Slides)

MR. WHITACRE: Once again, I have up here a little matrix which shows the entry flight test. I am only going to talk about a couple of these. We have also a series of testing to be done on entry -- the major ones of which are the aerodynamics, thermal and the autoland system.

And I will point out once again that we cannot get all of these done during the four flight OFT program. There is a large amount of testing that is done, particularly in the aero area, and I will show you more about that in just a moment.

(Slide)

MR. WHITACRE: In the aerodynamics area, what we are trying to do during entry is to show that this vehicle flies as planned. There is no other vehicle of this type and we are trying to show that the vehicle really flies the way we want it to fly.

The questions that came up -- how do you do that without perturbing the vehicle in any way that is unsafe during entry, and we looked at what kinds of programs did it take to do that and whether or not we had to have CG control on the vehicle, CG being gravity control on the vehicle, in order to allow it to accomplish this.

And also it was known that we had to do this, do that, in a series of different parts of the entry profile, the hypersonic regime, the supersonic, transsonic and the subsonic regime, to get a very good data base that shows the controlability of this vehicle. Go to the next two slides, please.

(Slides)

MR. WHITACRE: Now, the way it was determined that it was best to approach this, first off it was concluded from the testing and from the analysis that had to be done that you could not very effectively determine the entry aero characteristics of this

vehicle simply by flying it and getting that data back without having an excessively large number of flights required.

What you had to have is some clean control surface inputs and some clean vehicle responses to those control surface inputs. The way we do this is we put in what we call PTIs or ASIs, PTIs being program test inputs which are put in by computer, and ASIs which are control stick inputs which are put in by the crew.

So what we are doing is while we are flying the 40-degree Alpha Profile, we push over and pull up so we get a data base on heating and on vehicle response, what happens when you go into these other Alpha Profile regimes.

At the same time we are doing that, for the various flights that you see here, we set up different Elevon (ph.) schedules. The reason we do is by setting up different Elevon schedules and allowing the body flap to fall as it wishes to control the vehicle, we in effect simulate different CGs on the vehicle.

And so we have a variety of Elevon profiles that are used for flights one, two, three, four and several post-OFT flights. Go to the next slide, please.

MR. WHITACRE: Now, this gives you an example of how this is being accomplished during OFT. All of these little dots along these charts show that when we are performing each of these pull-over push-ups.

Individually we have run these on computer simulations with the crew involved and have shown that individually the maneuvers are safe to perform and do give the kind of responses, the kind of data that you want.

And we have also simulated total entry profiles with those maneuvers being introduced into it, so we are not using up too much propellant, that the crew can in fact handle all those maneuvers that the vehicle is going through at the time, so we don't have any kind of problem.

We do not get it all done, by a long shot, in OFT: and you can see the kinds of things that are left over from the post-OFT flights. I will comment more about that in just a moment. Next slide, please.

(Slide)

MR. WHITACRE: One other thing that should be said about the aerothermal aspects of this is, this is one of those situations where you "can't have your cake and eat it, too." We have a vehicle where we had two basic limits on it; one is the surface temperatures and the other is the bondline temperatures.

And as the surface temperature goes up, the bondline temper-

ature goes down, or vice versa. If you try to hold the surface temperature down, you let the bondline temperature go up.

So, very judiciously, our people have worked to try to pick out some points on OFT which allows us to gradually progress up in both of these areas. And you can see here the curves which explain what I am talking about.

We hold them down as much as possible on STS-1 and STS-2. These little dots here represent what's expected to be the temperatures. We allow them to go up a little bit on STS-3, get a good solid data base, and then on STS-4, we go to a different Alpha Profile so we get a different kind of entry heating, and you can see that those jump up dramatically and our margins go down dramatically. That is what is intended. We are trying to find out, again, how the vehicle is performing.

(Slide)

MR. WHITACRE: The next slide, which is page 35, is just an isotherm of the kind of temperatures we are expecting to get during entry, and every isotherm is different, depending on the profile you are flying. This is just a typical isotherm, it doesn't represent any single OFT flight or any other flight for that matter, but it does give you a pretty good idea of the kind of temperature distribution you are getting across the vehicle.

(Slide)

MR. WHITACRE: Again, slide 36 is similar to the previous one where we just list some of the things we are doing. In this case, I want to mention autoland. In autoland, we plan to land the OFT flight manually. And on flight two, go to the partial autoland where it is controlling down to the flare point. On flight three we use autoland to roll out, and the same on flight four, except that in flight four we are now landing on the runway, or at least this is our present plan.

And in post-OFT, when we go to KSC, we again go back to the autoland through flare, first, and then the autoland through rollout.

(Slide)

MR. WHITACRE: The last thing I want to say is we recognized, as "Deke" said, a long time ago that we weren't going to get through this all during OFT and that we were going to have to carry on into the post-OFT period.

We have planned accordingly. We have instrumented the 102 vehicle, and it is planned that the 099 will also have a smaller but adequate set of instrumentation. Once you have instrumented the vehicle and you have that capability, it means you can do the testing pretty much on a non-interference basis in most cases,

with payloads.

Now, it may very well take you several flights to complete this testing, several more. For example, in the aerodynamics, I showed we need five more flights. This does not mean it is going to be the first five post-OFT flights. It will be the first five flights where we can carry the instrumentation package and perform the -- as we need to.

So this is going to allow us to continue our testing on into the operational period and finish up our verification program. And that is pretty much what I have to say about the overall OFT planning. I will now turn it over to Larry Keyser.

VOICE: Now again, for the record, Mr. Keyser is the STS-1 Mission Staff Engineer for the Johnson Space Center.

MR. KEYSER: Does everybody have a copy of the missing charts? Did you make some extra copies?

VOICE: We have what you gave us.

MR. KEYSER: Okay. It turns out that the last 17 pages in my presentation somehow got inadvertently left off and there is a separate package up here for those who didn't get them. And those of you on the Net, I hope I can adequately refer to them when we get to that page.

I am an old school teacher and I am going to use this wooden pointer and not the electronic one.

(Slide)

MR. KEYSER: I am going to talk to you about the flight profile for the first mission. Ed has gone over the flight test objectives for the whole program. Next slide, please.

(Slide)

MR. KEYSER: There will be a short overview and then I want to talk about the nominal ascent, some ascent abort, then what some of the on orbit activities are, then the descent profile. Next slide, please.

(Slide)

MR. KEYSER: And here is the overview. Next slide, please, George.

(Slide)

MR. KEYSER: Okay. We are going to have a 54 1/2 hour flight in 150 nautical mile circular orbit. Ed mentioned the 40.3 degree Inclination. The Launch Date for this particular set of data was

taken from March 10th. Right now I understand it is in the neighborhood of March 14th.

These times will vary slightly depending on which launch data we pick. The launch window is 3 hours and 42 minutes, and that is determined by launch and landing lighting requirement. And the cut-off of the launch, sun-runway azimuth/elevation constraint, and the launch lighting is such that we need to take some pictures of launch phase and we can't get it too early in the morning. So that is determined at 7:23 in the morning Eastern Time.

And with that particular lift-off we are going to land at 10:53 a.m. at Edwards Air Force Base. Next slide, please.

(Slide)

MR. KEYSER: This is an overview of the sequence of events that happen during the entire mission. There will be several OMS burns. Now, the OMS is self-contained in the Orbiter propulsion system which is used to get into orbit. And we refer to this as the first OMS burn. The first one is OMS-1, the second one is OMS-2, and so forth. I am going to talk in a little bit more detail on each of these in the next slide, or in future slides.

(Slide)

MR. KEYSER: As far as the ascent is concerned -- we have two of them here -- okay, the numbers here correspond to the numbers over on the world map. And I would like to say, first, this particular vehicle gets into orbit a little bit differently than all of the previous ones.

On previous programs we have gotten into orbit while we still had communications to the Bermuda Tracking Station, they were around 10, 11, 12 minutes, something like that is when we were into orbit. But we are not going to get into orbit until around 47 minutes with the Shuttle, so there are going to be some people holding their breath for a longer period of time until we finally get into a safe orbit.

You will notice the perigees here are after we -- well, are 13 miles and 57 miles which... we consider a safe orbit for a 24-hour (inaudible) time, is 80 miles. So we are not in a safe orbit until we have the OMS-2 cut-off and we are in a 150 circular.

What is dictating doing these two OMS burns and taking longer to get in orbit is our desire not to have the external tank in orbit with us, and then we have the problem we had on Skylab, orbital debris, and so forth, where we are unable to predict where it is going to come down.

So we intentionally cut of the main engine burn early and then it comes on a ballistic trajectory into the Indian Ocean,

and then we proceed on to separate from it. We separate about 18 seconds after we have MECO at 8:50 and then do the OMS-1 burn two minutes after MECO.

SRB sep occurs two minutes and 12 seconds into the flight. Next slide, please.

(Slide)

MR. KEYSER: And this is just show you where the SRBs are going to land, about 140 miles off the coast; and they will be retrieved and reused. Next slide please.

(Slide)

MR. KEYSER: This is just to show the relative separation distance between the external tank in the Orbiter as it goes from here down through to here in about two minutes, which is about 400 feet and 200 feet, in that neighborhood, away from the external tank. And then the external tank goes on its way and does its ballistic trajectory, and right here is where we do the OMS-1 burn and proceed to get up into orbit. Next slide, please.

(Slide)

MR. KEYSER: Here is where we anticipate the external tank is going to impact -- right here in the Indian Ocean. This particular darker line extends from here to here, is where some of the pieces could fall in a worse case. Next slide, please.

(Slide)

MR. KEYSER: Okay. I would like to talk a little bit about the abort options we have during ascent. Next slide please.

(Slide)

MR. KEYSER: The ascent aborts, we like to have an intact abort capability, and we are going to do that to protect for single main engine or OMS engine failures. Next slide, please.

(Slide)

MR. KEYSER: We are on slide number 14 right now. As far as the intact abort modes are concerned, these are done to a preplanned landing site, not like a ballistics trajectory like the previous mission. This thing can fly and we are going to try to get it back to launch site. It is called a RTLS, return to launch site, as long as we can.

And that capability runs out as soon as you run out of enough propellant to run around and fly back. And then you have to next stage where you would press on into trying to get into orbit with whatever fuel you had remaining.

There are two different types of abort within it, after the press call this is determined by -- you keep building to get into orbit even after you have lost one main engine, one of the three main engines. That determines the start of the press to MECO.

And the two abort modes are: abort once around and abort to orbit. Next slide, please.

(Slide)

MR KEYSER: Here is a composite of the three abort modes. This is slide 15, and this is the last slide that some of you on the net have.

The arc to your left has the SRBs separate here and the SRBs fall into the Atlantic. It goes on, and roughly right in here is the last point where you could turn around and come back, and you turn the thing around and come back, to separate from the external tank, that fall into the water and you fly back to KSC. I have a couple of slides on each one of these modes just a little bit later so I will go on to a little bit more detail.

The external tank, you stay on it and you get up to MECO, and you are a little short of getting into the orbit you want, you are going to do a couple of slides on each one of these modes just a little bit later so I will go on to a little bit more detail.

The external tank, you stay on it and you get up to MECO, and you are a little short of getting into the orbit you want, you are going to do a couple of OMS burns, in either case in the AOA or ATO. In the AOA burn, it will get you to a landing at Northrup Strip in New Mexico.

The reason we are landing there is we don't have enough cross-range to get to Edwards.

The arc to your left lasts about 22 minutes, and the AOA will be about 107 minutes. Now, if we get into abort-to-orbit -- that is simply terminology, because we may continue the entire mission if we get into doing abort-to-orbit. I will explain that in a minute. Next slide, please.

(Slide)

MR. KEYSER: Hold it just a moment. Slide 16, you don't have on the net? All I wanted to show here is where the latest RTLS time -- I guess you would call that the point of no return where you cannot come back to the Cape, and that is about four minutes and 23 seconds into the flight.

And coincidentally, that is the time, 4:23 is the time where you have your first press to MECO capablility. In other words, if we lose one of the main engines right here, we could still get

into orbit with the other two.

Now, you cannot get into orbit, the ATO orbit, until about seven to 10 later; so there is about a seven to 10-second period in here that you have AOA capability only, but then after that you have both. Next slide, please.

(Slide)

MR. KEYSER: You don't have this on the net. I have two slides here, and the one on the left is just some words that tells that the RTLS is broken up into two stages. One is what is called the powered phase, and the glide return phase.

And an RTLS abort would be required when you have, like I said, a single engine out, prior to the time that you get the press to MECO capability, or if something else was wrong and you had to get back in less than 22 minutes or you are time-critical.

The chart on the right is a profile of the RTLS, and the numbers up at the top correspond to certain events. You do your staging and you can abort as late as 4:23 into the launch.

The powered phase goes clear around to here until you have ET sep, after you have your main cut-off. But as soon as you do initiate the abort, the vehicle changes attitutde and loft and goes a little higher to get more altitude.

And about right here they start pitching around, and when they get over here they are actually flying backwards, and pointing back towards the Cape still burning the main engines. And when they get down to here, they have to get in the right attitude for separation, so they start pitching down. And then they have MECO and ET sep, and the external tank goes on into the water there in the Atlantic, and the Orbiter follows this kind of a profile.

It has to pitch over to gain enough speed so that it can follow an equillibrium slide boundary on into landing. The reason it has to pick up the speed is because the requirements for ET sep here are -- you've got to keep the dynamic pressure down. Next slide, please.

(Slide)

MR. KEYSER: As far as the abort-once-around is concerned, here are two more slides, a word chart on the left. If you have enough energy to get at least one rev and land at Northrup Strip, and it requires tow maneuvers with the OMS-1 to set up an apogee, and an OMS-2 which is the orbit burn and gives you the normal entry conditions -- and you do this if you have a single engine out prior to being able to do an ATO, or if you are time-critical and didn't want to go into orbit.

The chart on the right shows a little bit of the geometry of an ATO. You lift off, and you don't have to make the decision that you are going to do an ATO right away. You can do a normal OMS-1, and then sometime in this time frame you determined that you were time-critical and had to come back, and you could turn around and do an OMS-2 and enter at Northrup Strip in that particular case.

But what OMS-1 does is it puts you in a 105-nautical mile apogee, and you do the OMS burn roughly at apogee, and come almost to complete rev and land at Northrup Strip. Next slide, please..

(Slide)

MR. KEYSER: The abort-to-orbit, two charts again, a word chart on the left. What we try to do to abort-to-orbit is to get into a 105 nautical mile circular orbit, which is safe for several days, but we don't have enough energy to go on into a normal 150 mile orbit.

So what we will do is similar to nominal mission, get up to 105 instead of 150 for apogee, and then we will circularize at 105 instead of 150. And this is required only when -- you will only do this type of an abort when we just don't have enough fuel to get into orbit. Next slide, please.

(Slide)

MR. KEYSER: This is a graphic of the geometry of an ATO. Getting into orbit here shortly after MECO, you determine that before OMS-1 you have to know very soon, within this two minute period that you are going to do an ATO so you can target for 105 here instead of 150, so then he burns this one to get his 105, and then over here he goes 150.

Now, depending on what is wrong, if there is nothing wrong, and depending on how much fuel we have got left, what we will do is we will do two more OMS burns later on the first day to raise this up on either and make it circular, as high as we can within the fuel we have got remaining.

The reason we want to go a little higher is it gives us better communications coverage with the tracking station. Next slide, please.

MR. KEYSER: In addition to these intact abort modes, there are contingency abort modes where if you lose two engines at an inopportune time or three engines at an inopportune time, or if you miss the runway, you can just eject the -- crew has the capability of ejecting from the Orbiter and letting it ditch. Next slide, please.

(Slide)

MR. KEYSER: I have three slides on the on-orbit timeline. Next slide, please.

(Slide)

MR. KEYSER: What I have done here is shown you the timeline along the bottom in hours, and I have the orbit opportunities for each orbit. You notice there is none right in here where we don't have a capability, or cross-range capability to get to any of these sites.

The primary landing site is Edwards in California, with the "E". What is going to happen on the first day is, after we get into orbit with the OMS-1 and OMS-2 burn, the first thing we are going to do is get the payload bay doors open. If we don't get the payload bay doors open, we have to come back in that same day.

We use up some water we have on board to do the cooling, and if we don't get the doors open, and radiators that radiate the heat to outer space are inside the doors, and this will be the first opportunity for TV. This is going to be about an hour and a half to two hours after liftoff. They will have the TV cameras on and you will be able to have a TV show.

The next several events that are happening are just getting the Orbiter set up to stay in orbit from the launch phase. You will have another TV show roughly at 8 hours and 9 1/2 hours, two separate ones. The first one is going to be of the pilot in the crew quarters and the second will be the commander and pilot in the aft flight deck.

After that, they will eat supper and go to sleep. Next slide, please.

(Slide)

MR. KEYSER: The second day is planned around a deorbit rehearsal, which is going to begin roughly right in here, 23 hours, 24 hours, and the end about 30 hours. And this particular sequence of events that happen from begin deorbit rehearsal to end deorbit are the identical timeline that the crew is going to do on the next day when they really plan to come in. Now if there is something wrong we will come in on this particular day, if we don't choose to go past this particular time.

Subsequent to the deorbit rehearsal, we will open the payload bay door again. We close them here to get ready for entry, and get the system set back up, the orbit set back up to fly for another day, do a couple of OMS manuevers, and these are some test burns that Ed talked about.

There is a TV planned on this particular second day two of them as a matter of fact; about 24 hours (into the flight) there

is in the cockpit of the flight control system checkout, and about 34 hours, TV of the mid-deck over Hawaii. Next slide, please.

MR. KEYSER: And then they will go to bed. And after they get up on day three, they wil do the same thing they did the previous day as far as the timeline is concerned that they have already rehearsed, and come in and land roughtly 54 1/2 hours later. Next slide, please.

(Slide)

MR. KEYSER: And now a few words on the Descent Phase. Slide, please.

(Slide)

MR. KEYSER: Four different phases you might think of is the deorbit phase which starts at the time they try to start their attitude maneuvers to get into position to do the deorbit burn. And that is about 53 hours and 23 minutes into the flight.

And after they do the burn, the second phase is entry interface which is about 400,000 feet, and is about 35 minutes later. Third phase is called TAEM, or terminal aero energy management, and that is very close to the states when they get there. It is another 25 minutes and they are at 8,400 feet and about six minutes from landing.

And five minutes later, they go into the approach and landing phase when they are pointing straight down the runway, and one minute from touchdown. Next slide, please.

(Slide)

MR. KEYSER: Here is a look at where they are going to be. They are going to be back in here at the start of the entry phase, when they do the attitude maneuvers to get into position for the burn right here.

Then after they do the orbit burn, they will turn around into entry attitude. We will talk to them over Guam to find out how well they did the burn, and the entry interface occurs right here to TAEM Interface. Next slide, please.

(Slide)

MR. KEYSER: This final slide shows how they are going to approach and land at Edwards Air Force Base. They will be coming in from the west right over here, slide right over the runway, all the time dropping, turn around and then the TAEM phase ends right here. And they begin the approach and landing phase about one minute from touchdown, and they will touch down right here. That is it.

VOICE: Okay, ladies and gentlemen, please wait for the microphone and please identify yourselves and your affiliation. May I have the first question, please? At the moment we don't have any questions Houston. How about at Headquarters? Stand by, please.

MR. COVAULT: This is Craig Covault, at Aviation Week. Larry, can you discuss the status of thrust limiting in the program right now to avoid RTLS?

MR KEYSER: No.

MR. SLAYTON: I think, Craig, you are referring obviously to our problems with a nozzle on MPT and what that does to us in a thrust limiting world. And I think we are not sure what that means right this minute.

MR. COVAULT: Say again, Deke. I couldn't hear you.

MR. SLAYTON: I presume you are referring to the nozzle splits on MPT and what that does to use in a thrust limiting master plan. Is that correct?

MR. COVAULT: Not so much on the MPT incidents as just the status of using it irregardless of the incident.

MR. SLAYTON: Well, I don't know what to tell you, either, about that other than I think we are still planning to use it, and the detail techniques of how that is all computered. I don't think any of us here are any smarter than you are about that one in terms of giving you a detailed description of it. Al, have you got any...

MR. ROSSITER: This is Al Rossiter with UPI. I would like to know a little bit more about Monday's MPT problem and whether there is any possibility at all that it could affect the move to the VAB, the 23rd.

MR. SLAYTON: I don't think you've got the right guys on the loop to give you the bottom line on that. I can tell you what I know about it which is second or third hand. We appear to have had a failure in the nozzle which dumped hydrogen and ended up with an over tempt on the pump because we were running LOX rich and that is what caused the shut-down.

We think there is no damage to the basic engine. We think our problem is primarily a bad braze on our nozzle. We knew we had a nozzle. We knew we had a nozzle that was out of spec at the time, and we need to find another nozzle and go continue that run.

We intend to put the engine -- this weekend per plan and press on to the pad. And I guess the worse that can happen is at some point we might have to change out flight nozzles and in a

worse case maybe even the engines. But we can do that in the vertical. But to answer your question, we don't think that will have any impact on rollout or mating.

MR. COVAULT: This is Craig Covault again. Deke, an IMU question on this turn-around of the IMU in the countdown if you need to, has JSC decided how long you can hold on the IMU -- I understand it went all the way up to about 50 minutes which could really open things up for you if you got that much hold time on it before recycling it?

MR. SLAYTON: We got a hundred right now. We had another constraint that was an ADI (attitude direction indicator) constraint. We need a "read-write" in the LCC (launch commit criteria) to fix that problem. That was giving us a 20-minute hold and we think we are going to get that approved.

Right now we can cope with a total of two hours in OPS-1, (a computer software mode) which gives us 20 minutes for counting and a 100 minutes for hold. We know we are going to have something (inaudible) at 50 or 60 minutes, we will obviously recycle back to 71 minutes and pick up from there anyway. I guess in essence we've got almost unlimited capability right now.

MR. ROSSITER: This is Rossiter again. Can you discuss the change in you target from March 10th to March 14th? I understand someone just added another test and that was the reason it was stretched out four days.

MR. SLAYTON: That is exactly right. We had a series of seven missions runs and SIT (Shuttle Integrated Test). There was not an LRV, a launch verification in after FRF. We put that in and that represents about the four days. The other modification they did the program at the same time we did put in an APU (auxiliary power unit) hot fire ahead of the FRF, but that is no schedule impact. That is where the four days is.

MR. COVAULT: This is Covault again. Deke, could you review any maturation or maturing of the OFT Program that you may have done as you looked at things in the last several months? And where are some areas in the OFT Program itself that you might think seriously about changing if things went especially well on STS-1?

MR. SLAYTON: Well, if your question is: Do we have any "hip pocket" plan to cut back on the number of flights and do the program quicker, I don't think we do. We are based on a success schedule right now. And as you are aware of, we do have some performance problems staring us in the face downstream, and we are going to have to make some modifications, most likely one we understand all of that.

I personally don't visualize any great change in the structure of it from four flights to three, two or that kind of busi-

ness. There probably will be some changing around of payloads as we go. We are not prepared to discuss that in detail today either.

MR. GAVER: Okay. That is all the questions from Headquarters.

MR. GORDON: Okay. Kennedy Space Center, do we have questions from you?

VOICE: Yes, we do; just one moment.

MR. LEWIS: This is Dick Lewis, freelance. We don't have the last 17 pages and consequently, we were lost when the briefer talked about "here" and "there" on the descent profile.

I would like to ask the following questions: At what approximate geographical position would the vehicle be at the time of the reentry burn at entry or at the 400,000 foot mark? In other words, where approximately does this vehicle reenter?

MR. KEYSER: Okay. The deorbit burn is going to occur around 70 degrees east longitude and 40 degrees south. That is in the Indian Ocean almost equidistant between Africa and Australia.

MR. LEWIS: Okay. That is fine.

MR. KEYSER: And then the 400,000 interface is at 160 east and 20 degrees north.

MR. LEWIS: 20 north.

MR. KEYSER: That is up there west of Hawaii.

MR. LEWIS: West of Hawaii? Right. Okay. When does black end? Do you have a number on that or approximate position?

MR. KEYSER: A position for blackout. Roughly 125 west longitude. That would be the end of blackout. Now, you referred to an altitude of 84,000 feet six minutes from landing. Would that be approximately over Orlando, Florida?

MR. KEYSER: No. We are coming into Edwards.

MR. LEWIS: Okay. I'm sorry -- in the Edwards descent, where would that be?

MR. KEYSER: Probably about two, three hundred miles inland from the coast.

MR. SLAYTON: Probably picked the right place, though, for a Kennedy landing.

MR. LEWIS: Yeah. Okay. Two or three hundred miles inland from the Pacific Coast? Is that correct?

MR. KEYSER: That is correct; just a guess.

MR. LEWIS: What happens then? Does he swing around and go back out west to land?

MR. KEYSER: That is correct. He flies straight east directly over the runway, turns around in big circle, comes back and lands.

MR. LEWIS: Okay.

MR. GORDON: Again, we are sorry about the foul-up on these vugraphs. They got inadvertently left out of the package when they were sent yesterday afternoon.

VOICE: We have one additional question from KSC. For Deke Slayton: Would the possibility of up to 500 questionable tiles, are there any plans to install tiles after the Shuttle, after the Orbiter has been transferred to the VAB, or must all of the tiles be in place before the transfer from the OFT takes place?

MR. SLAYTON: We would like to get them all installed before we move. That is our master plan. I am sure if we end up in a situation where we've got two or three close-outs or something and we have to wait for them to get manufactured, and delivered, and we are talking days or possibly weeks, where we are.

VOICE: That is all from Kennedy.

MR. GORDON: Thank you. Marshall?

VOICE: Yes. Stand by one second.

MR. DOOLING: Dave Dooling with the Huntsville Times. First off, for Public Affairs, if the transcript of the Aaron Cohen briefing a couple of weeks ago was ever secured, we didn't get them up here.

A couple of questions about payload. The SPAS payload from Germany was mentioned as a test article for the RMS. I thought there was special structure being built for use on OFT-3 for that purpose.

MR. WHITACRE: There is a special structure being built for OFT-1. The SPAS. One test article is for the approach and capture testing, and that is presently scheduled for flight six.

MR. DOOLING: So the PDRS article will not be released, then, during its test?

MR. WHITACRE: The PDRS test article is not intended to

actually be released into free flight. We do unlatch, if you will, the end of the grapple mechanism but we do not actually let go of the PDRS test article on flight three.

The reason for that is just so, frankly, in case you have any problems you don't have something floating free in orbit that you really don't want to be there.

MR. DOOLING: Okay. On the OFT-4 payload, I notice that you have the OSS-1 pallet hooked in there. Is that firm now or is the Air Force P80-1, I believe, -- is that still the priority?

MR. WHITACRE: Both of them are still candidate payloads.

MR. KEYSER: OSS-1 is our official payload on our current manifesting.

MR. DOOLING: Okay. And on the flight numbering for the operational flight, I notice that you have 0201. Does the refer to the Orbiter fuselage number and then the flight number?

MR. WHITACRE: What chart are you looking at?

MR. DOOLING: It is several of them after the four OFT flights that has the operational flights designated, 0201, 0202, and so on. And I wondering if that indicating flight number one for OV-102, and flight...

MR. WHITACRE: No. I think the chart you are referring to is the one on the XCG Expansion Plan, and those numbering refer to DTO numbers, detail test objective numbers. They are not associated with the specific flight because they may not occur on the first or the second or the third post-OFT flight. Those are the numbers of the detail test objectives.

MR. DOOLING: Okay. No more question for now.

MR. GORDON: Do we have questions from Houston? Louie Alexander in the back, sir.

MR. ALEXANDER: Yes. I have two questions. First of all, for the first flight you are talking about having the Northrup Strip available as an alternate or an emergency landing. Will any of those four other fields you mentioned be ready for that first flight if they are needed?

MR. KEYSER: Yes, sir.

MR. ALEXANDER: And can the spacecraft land anywhere else on land or water if absolutely necessary?

MR. KEYSER: Not water, but if you can find a runway of 10,000 foot or so, we could land on it.

MR. ALEXANDER: The other question is: I see in this plan no EVA Plan, no extra vehicular space walk. Is there any capability for that if there is trouble on the flight?

MR. KEYSER: Yes, sir. The capability will exist but we are not going to plan it.

MR. ALEXANDER: They will have the suits on available, and all the rest. Thank you.

MR. SLAYTON: To clarify your question on landing sites, we do have some preferred contingency landing sites. Larry is right; we can land anywhere we can get to or will try to. But we have a base in Rhoda, Spain; we have a base in Okinawa; we have Hawaii -- that are all what we call our contingency landing sites, which would be our preference to dump into one of those places other than our prime into mission sites.

One other clarification we ought to make on AOA first flight we obviously prefer to go the Northrup Strip because of the little cross-range. However, if Northrup Strip ends up rained out, or something, on the first flight, we can go to Edwards, and would. It gives us a lot more cross-range. We prefer not to but it wouldn'be a "show stopper."

MR. KEYSER: We would change the launch profile just a little bit for that to take away some of the cross range.

MR. GORDON: Carlos Byers, please.

MR. BYERS: Yes. I missed something somewhere on the tiles situation. You have 5-0 questionable. How else do you stand on tiles?

MR. SLAYTON: Let me review my numbers again. We have got a known 520 cavities as of to date, and we know of another 28 we are going to remove,which gives us a total of 548 known.

On top of that we have a number of DRs (design reviews), IDRs (intermediate design reviews) on tile that have to be dispositioned. There is up to 500, in that "ball park" of those kinds. In a worse case, we could end up having to change out all 500 of those. However, the last word I had they are very optimistic and believe that most of those we will be able to disposition as is. That is the best I can tell you on that. We won't be any smarter on that for another few days, obviously.

In any case, if we did have to do that, we are still going to be in good shape to make the 23rd rollout. We have been putting on, in the "ball-park" of 500 a week, so what we know of it is like a week's work here.

The problem, as you would guess, is the closer we get to the end we end up with some very specialized ones, and we may have to

take some splashes -- and there is nothing in our pipeline to speak of. Everything is there that we know of, and in some cases we may have to take splashes back to Palmdale, get them built and bring them back to the Cape. That is the case I am talking about where we might consider moving with a few missing.

VOICE: (inaudible) Flight test summarizing --

MR. SLAYTON: Yes, very nicely. We want to get up and get down safely, and that is really the only objective. If we can get through a launch and into orbit and get through an entry and back on the ground, in my opinion we would have completed a very successful flight.

And what happens on orbit, obviously we would like to stay up for a couple of days, but the on orbit stuff is relatively easy and benign, comparatively. When people say, What is the tough part of the space flight? Well, that is it, geting up and getting down. Space flight is easy, and that is where our biggest problems may lie.

Well, it is the amount of data we are trying to get and we can't get it on one flight. It is, again, we tried to "walk" through that with Ed's presentation, trying to do things sequentially. We can go back and review those charts, if you like but just to pick a typical launch dynamic pressure, we want to work up on that gradually. We don't want to go to our design value on our first flight because there are too many uncertainties. We aren't that smart.

We have a lot of wind tunnel data, we have a lot of structural analysis, but you just don't really know what you've got until you go fly it, so you try to make it as easy as you can and then we work into it gradually. It just takes a few flights to do those things.

We started in spreading it over six, we now have it spread over four; but we think we can't squeeze it any more that that. Well, I don't even know how to compute that one. There are probably 20 major systems and -- we can get you a count on that.

VOICE: I believe we have one from Jeremy Rose over here.

MR. ROSE: Getting back to the tile problem, if I may ask a very basic question. What is the main problem with fixing them? Have you actually solved the problem with the fixing or are you just patching up and hoping that the problem will resolve itself and you will be able to find out the proper answer once the flight has taken place?

MR. SLAYTON: We don't think we have tile problem. We think we understand the tile, we think that the ones that are on there are there to stay. And the things I am talking about here are the typical manufacturing type things where you have a little crack

or little chip, or those kinds of things. We have a spec value for what is acceptable, we have a spec value for unevenness and we have some that are outside of that, roughness criteria.

Each one of these has to be looked at by the experts individually and dispositioned. But as far as a basic design problem, we don't think we have one right now. We think we understand the system.

MR. ROSE: How many tiles totally are there?

MR. SLAYTON: There are over 31,000, and I can't give you the exact number, again. If you want it we can get it for you.

MR. GORDON: We have no more questions from Houston. We will check the net -- Headquarters? Okay. Marshall, are you finished?

VOICE: We have one more here at Marshall.

MR. DOOLING: Dave Dooling again. Would you elaborate a little bit on that extra test that was added to slip the launch to March 14, and could you give us what the crew assignments are for OFT two, three and four?

MR. SLAYTON: The answer to you last question is no. We have announced the crew for first flight, and I don't think we are prepared to talk beyond that today.

The test we added is a launch verification test, which is similar to the integrated tests that we are running in the VAB, except it happens on the pad after FRF. And it is in there to give us the late verification after we have run the flight readiness firing of our total systems, fairly close into launch. Again, I don't have the schedule with me and I can't tell you where it is in relation to launch, but it is about T minus three weeks "ball park."

So we should be very close to our Launch configuration at that time and this is just a final verification test. I think we rerunning a nominal ascent, a nominal descent and an RTLS -- are the three ones that are planned there. I believe that is correct.

VOICE: Okay. That is all from Marshall.

MR. GORDON: Kennedy, do you have any more? No more. Thank you very much, Deke, Ed, Larry.

(Whereupon, the briefing and presentation was concluded.)

ORBITAL FLIGHT TEST PROGRAM

NOVEMBER 5, 1980

PRESENTED BY

DONALD K. SLAYTON

ORBITAL FLIGHT TEST PROGRAM (OFT)

WHAT IS IT

- THE OFT IS A FOUR ORBITAL FLIGHT TEST PROGRAM, WITH LAUNCHES AT KENNEDY SPACE CENTER AND NOMINAL LANDINGS AT EDWARDS AIR FORCE BASE, WHICH HAS BEEN PLANNED TO VERIFY AN EARLY OPERATIONAL CAPABILITY OF THE SPACE TRANSPORTATION SYSTEM.

OBJECTIVES

- CONDUCT A TEST PROGRAM WHICH CONFIRMS THE INITIAL DESIGN AND PERFORMANCE CAPABILITIES OF THE STS, RELATIVE TO DESIGN OBJECTIVES WITH THE MINIMUM NUMBER OF FLIGHTS.

MAJOR CONSIDERATIONS

- GROUND TESTS AND ANALYSES RESULTS.
- ACCEPTABLE RISK BUILDUP OF FLIGHT TEST ENVELOPE.
- ANALYSIS OF TEST DATA TO CLEAR NEXT FLIGHT.
- HARDWARE AND SOFTWARE AVAILABILITY.
- TURNAROUND OPERATIONS.
- DEMONSTRATION OF PAYLOADS SERVICES CAPABILITIES.

ORBITAL FLIGHT TEST PROGRAM

OFT APPROACH

- PROGRESSIVE EXPANSION OF THE VEHICLE FLIGHT ENVELOPE TO MAXIMIZE VERIFIED OPERATIONAL READINESS IN FOUR FLIGHTS.

- RECOGNITION THAT "FLIGHT TEST" TO "OPERATIONS" IS A GRADUAL PROCESS WHICH REQUIRES POST OFT INSTRUMENTATION AND TESTS BUT WHICH ALSO ALLOWS THE ACCOMPLISHMENT OF SIGNIFICANT PAYLOADS OBJECTIVES DURING OFT.

- DEFINITION OF REQUIRED FLIGHT TESTS BY RESPONSIBLE ENGINEERING ELEMENTS BASED ON GROUND TESTS LIMITATIONS, HARDWARE AVAILABILITY, VEHICLE OPERATIONAL OBJECTIVES, ETC.

- ANALYSIS OF FLIGHT, SYSTEMS, AND CREW CAPABILITIES TO SUPPORT TESTS ASSIGNED TO EACH FLIGHT, INCLUDING SIMULATIONS AND CREW PROCEDURES DEVELOPMENT.

SPACE SHUTTLE PROGRAM

OFT FLIGHT TEST PREPARATION

- OVERALL STATUS
  - MAJOR PART OF ORBITER TEST AND CHECKOUT COMPLETED WITH GOOD RESULTS
  - LAUNCH FACILITIES ESSENTIALLY COMPLETED FOR OPERATIONAL ACTIVITIES
  - LANDING FACILITY PREPARATIONS PROGRESSING SATISFACTORILY
    - EDWARDS AFB/DFRC FACILITIES ESSENTIALLY COMPLETED FOR OPERATIONAL ACTIVITIES
    - NORTHRUP STRIP AIRFIELD OPERATIONALLY READY; LANDING SUPPORT AND TURN-AROUND FACILITY PREPARATION ON-SCHEDULE
- FLIGHT CREW, LAUNCH OPERATIONS; FLIGHT CONTROL OPERATIONS AND ORBITER TURN-AROUND OPERATIONS PREPARATION ON SCHEDULE
- LONG DURATION INTEGRATED MISSION SIMULATIONS ARE SCHEDULED FOR DECEMBER.
  - A MISSION VERIFICATION TEST WILL BE CONDUCTED IN FEBRUARY 1981.
- STS-1 OUTLOOK
  - ALL OPERATIONS TEAMS AND THEIR SUPPORT ELEMENTS WILL BE MISSION READY AHEAD OF SCHEDULE
  - LAUNCH COMMIT CRITERIA HAS BEEN REFINED TO IMPROVE LAUNCH PROBABILITIES.

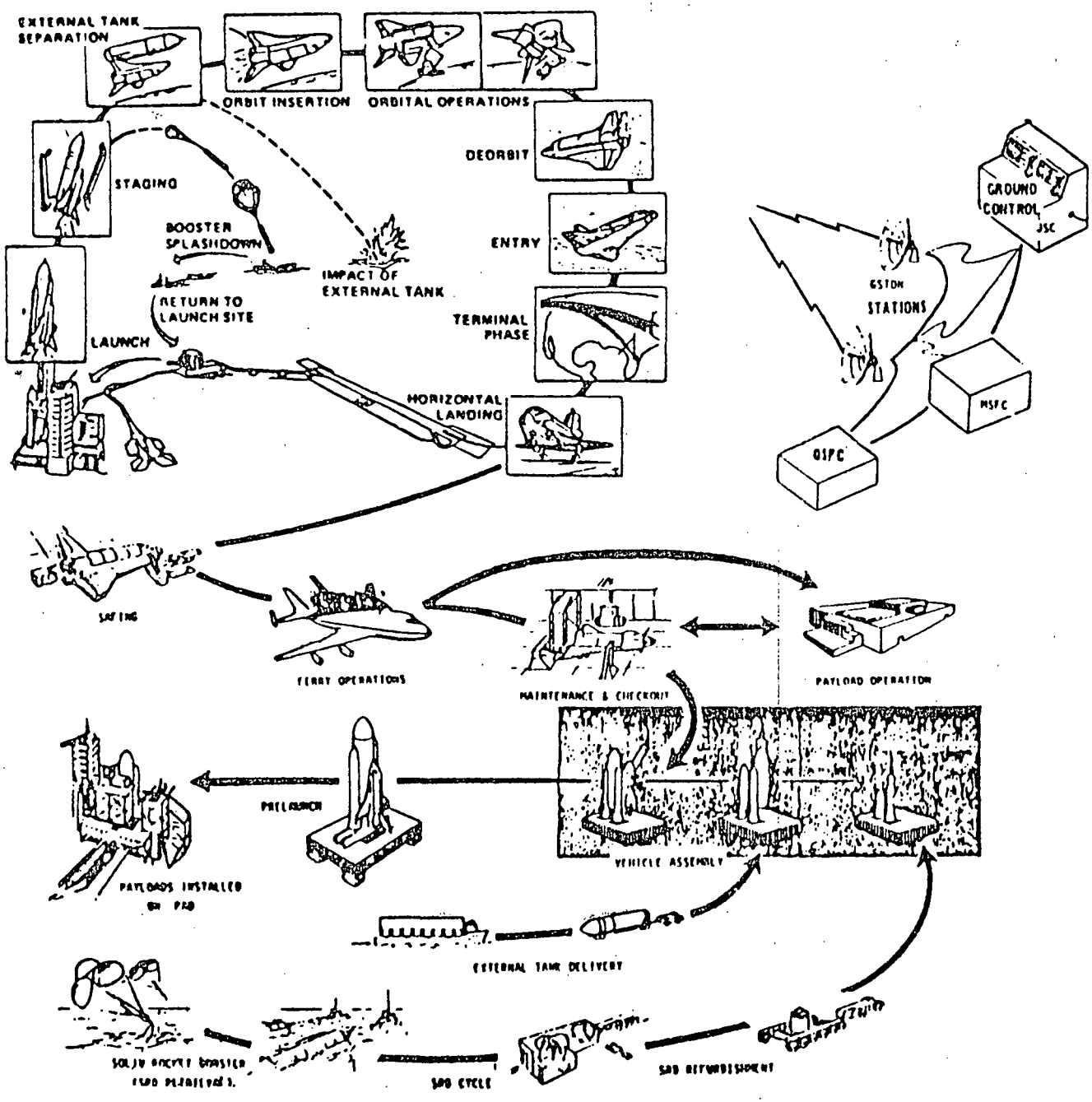
MAJOR TEST DRIVERS

- ASCENT ENVELOPE AND PERFORMANCE
- ENTRY AERODYNAMICS AND FLIGHT CONTROL
- ENTRY THERMAL PROTECTION SYSTEM (MAX SURFACE AND BONDLINE TEMP)
- THERMAL CONTROL SUBSYSTEM (ON ORBIT ATTITUDES)
- OPERATIONAL PERFORMANCE OF VEHICLE SUBSYSTEMS (OMS, RCS, ECLSS, EPS, --)

THE ORBITAL FLIGHT TEST PROGRAM

LM/H. E. WHITACRE

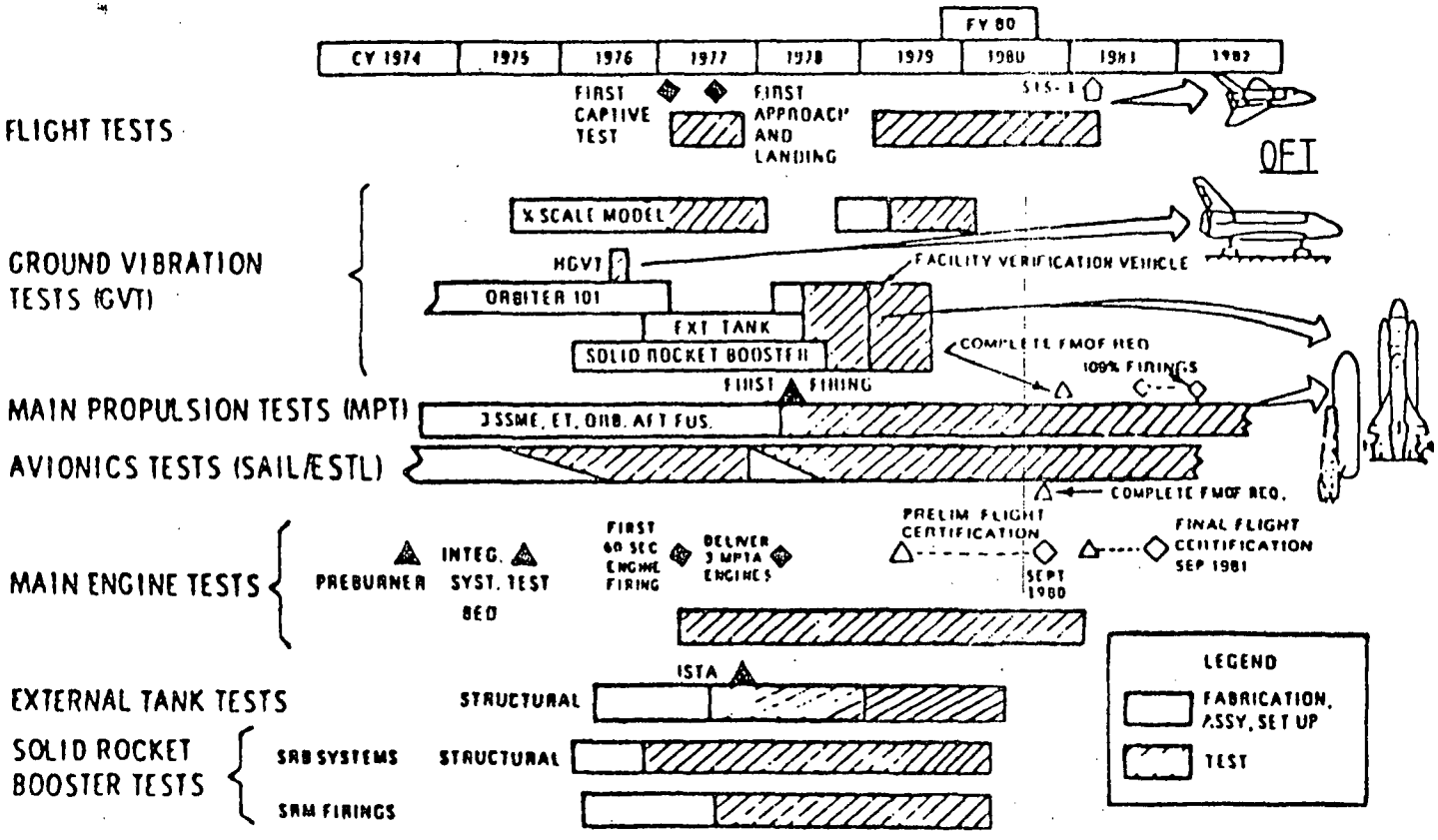
ORBITAL FLIGHT TEST PROGRAM



OFT PROVIDES VERIFICATION NOT ONLY OF THE FLIGHT VEHICLE, BUT ALSO OF THE EXTENSIVE NETWORK OF SUPPORTING FACILITIES, EQUIPMENT, PROCEDURES, AND PERSONNEL WHICH ARE A PART OF THE SPACE TRANSPORTATION CAPABILITY.

ORBITAL FLIGHT TEST PROGRAM

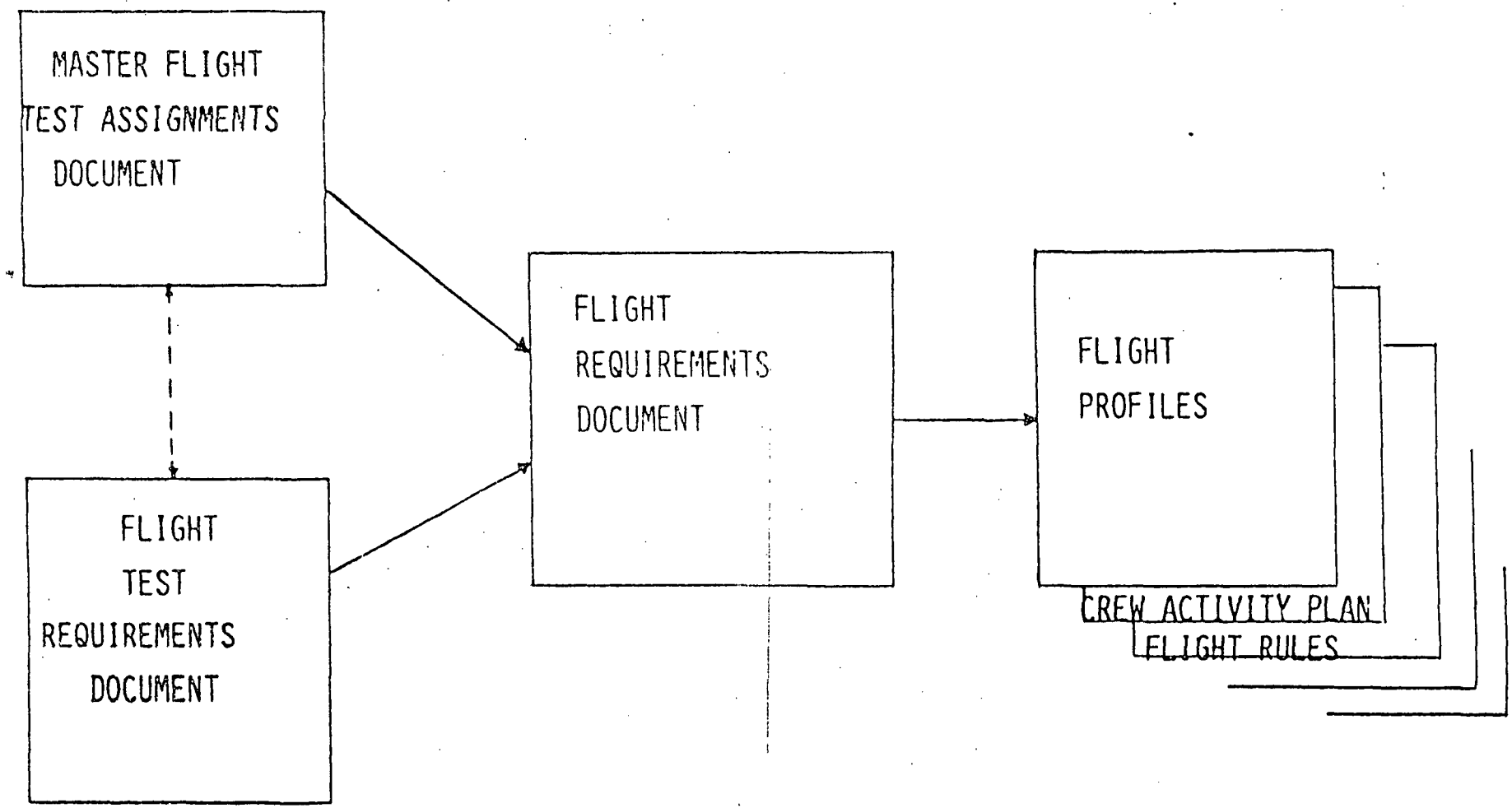
THE FLIGHT TEST OF VEHICLE SYSTEMS IS THE CONCLUDING VERIFICATION EFFORT IN A LONG SERIES OF COMPONENT/SUBSYSTEM/SYSTEMS TESTS INITIALLY CONDUCTED IN GROUND FACILITIES



FLIGHT TEST PROVIDES:

- INTEGRATED MAN/MACHINE/SOFTWARE INTERACTIONS
- ZERO "G" EFFECTS
- FULL SCALE AERODYNAMIC FLOWFIELD AND CONTROL SYSTEM RESPONSES
- REAL WORLD FULL SCALE THERMAL/VACUUM CONDITIONS
- DYNAMIC ASCENT AND ENTRY LOADS
- ENTRY HEATING

ORBITAL FLIGHT TEST PROGRAM



OFT SUMMARY

OFT FLIGHT REQUIREMENTS DEFINITION & FLIGHT PLANNING

ASCENT

- VEHICLE LOADS < WIND BIASING, ENGINE THROTTLING
- THERMAL STRESS
- SEPARATION TECHNIQUES < ET, SRB
- COMMUNICATIONS COVERAGE
- VEHICLE PERFORMANCE < SSME, SRB, OMS
- CONTROL LAWS
- ABORT PLANS < RTLS, AOA, EJECTION SEATS > LANDING SITES
- TELEMETRY
- CONSUMABLES
- POWER PROFILES
- INSERTION REQUIREMENTS
- ERROR SOURCES
- RANGE SAFETY
- CREW ACTIVITIES
- NATURAL ENVIRONMENT STUDIES
- FLIGHT TEST REQUIREMENTS
- SRB FLIGHT PATH
- ET FLIGHT PATH

ON-ORBIT

- ATTITUDE LIMITATIONS
  - POWER PROFILES
  - VEHICLE COOLING
  - PROPELLANT CONSUMPTION
  - TELEMETRY & COMMUNICATIONS
- CREW ACTIVITIES
- FLIGHT TEST REQ. < FLIGHT PROFILES, HARDWARE OPER.
- PAYLOADS
- RMS UTILIZATION
- CONSUMABLES MANAGEMENT
- GUIDANCE & NAVIGATION
- EVA OPERATIONS
- RENDEZVOUS TECHNIQUES
- STATIONKEEPING PROCEDURES
- APPROACH & CAPTURE OPERATIONS
- DEORBIT PREPARATIONS

DEORBIT & ENTRY

- GUIDANCE & NAVIGATION
- ERROR SOURCES/DISPERSIONS
- VEHICLE LOADS AND C.G.
- AERODYNAMIC PERFORMANCE < DYNAMIC PRESSURE, L/D, BOUNDARY LAYER TRIPPING, AERODYNAMIC UNCERTAINTIES
- ENERGY MGMNT
- COMMUNICATIONS
- FLIGHT CONTROL SYSTEM PERFORMANCE LIMITATIONS
- RCS BACKUP CAPABILITY
- SONIC BOOM CONDITIONS
- REDESIGNATION CAPABILITIES
- CREW WORK LOAD
- WINDS ANALYSES
- FLIGHT TEST REQUIREMENTS
- ABORT/GITCH CAPABILITIES
- TERMINAL AREA MANEUVERS

OFT PROGRAM

FLIGHT	STS-1	STS-2	STS-3	STS-4
DATE	10 MARCH 81	AUG 81	DEC 81	APR 82
INCLINATION	40.3°	40.3°	38°	38°
ALTITUDE	150 NM	150 NM	150 NM	165 NM
ASCENT Q MAX	580 PSF	620 PSF	650 PSF	680 PSF
Q MAX DISPERSED	660 PSF	720 PSF	765 PSF	790 PSF
MECO ALTITUDE	60 NM	60 NM	57 NM	55 NM
FLIGHT DURATION	54 HRS	4 DAYS	7 DAYS	7 DAYS
CREW SIZE	2	2	2	2
C.G. AT MACH 3,	66.7	66.6	66.7	66.5
ALPHA ANGLE	40°	40°	40°	38°/28°
B.L./SURF TEMP	30/2504°	30/2540°	35/2545°	340/2595°
LANDING SITE	EAFB LAKEBED	EAFB LAKEBED	EAFB LAKEBED	EAFB RUNWAY
AUTOLAND MODE	MANUAL	AUTO TO FLARE, MAN. LAND	AUTO THRU ROLLOUT	AUTO THRU ROLLOUT
CARGO	DFI, IECM, ACIP	OSTA-1 PALLET DFI, IECM, ACIP, MLR	PDRS TEST ARTICLE DFI, IECM, ACIP, MLR	OSS-1, GAS DFI, IECM, ACIP, MLR

SYSTEMS TESTING OVERVIEW

MAJOR SYSTEMS TESTING	1	2	3	4	POST OFT
O ASCENT PERFORMANCE (STRUCTURES, MPS, SRB & ET)	D	D	D	D	D
O ASCENT FLUTTER/BUFFET	D	X	X	X	
O PAYLOAD BAY DOOR TESTS (MECH & THERMAL)	X	X	X	X	X
O COMMUNICATIONS AND TRACKING (S-BAND, KU-BAND, UHF)	X	X	D	D	X
O GUIDANCE/NAVIGATION TESTS	X	X	X	X	X
O FLIGHT CONTROL/RCS TESTS (PRIMARY AND BACK UP)	X	X	X	D	
O. OMS SYSTEMS TESTS	X	X	X	X	X
O THERMAL TESTS (ATTITUDES & PROPULSION SOAKBACKS)	X	X	X	X	X
O PAYLOAD DEPLOYMENT AND RETRIEVAL SYSTEM TESTS		X	X	D	X
O ENVIRONMENTAL/TEMPERATURE/POWER SYSTEMS	X	X	X	X	
O EVA SYSTEMS VERIFICATION		X			X
O CONTAMINATION MONITORING AND PLUME SURVEY	D	D	X	X	X
O RENDEZVOUS, PROXIMITY OPERATIONS, RELEASE & CAPTURE					X
O ENTRY AEROTHERMAL/AERODYNAMICS	D	X	X	X	X
O ENTRY STRUCTURAL	D	X	X	D	
O CREW ACCOMMODATIONS	X	X	X	X	X

- 1180 TESTS HAVE BEEN IDENTIFIED FOR VERIFICATION TO CEI SPEC
- DATA IS ACQUIRED BY APPROXIMATELY 3500 DFI SENSORS LOCATED THROUGHOUT THE VEHICLE

X = ACTIVITY AND DATA COLLECTION

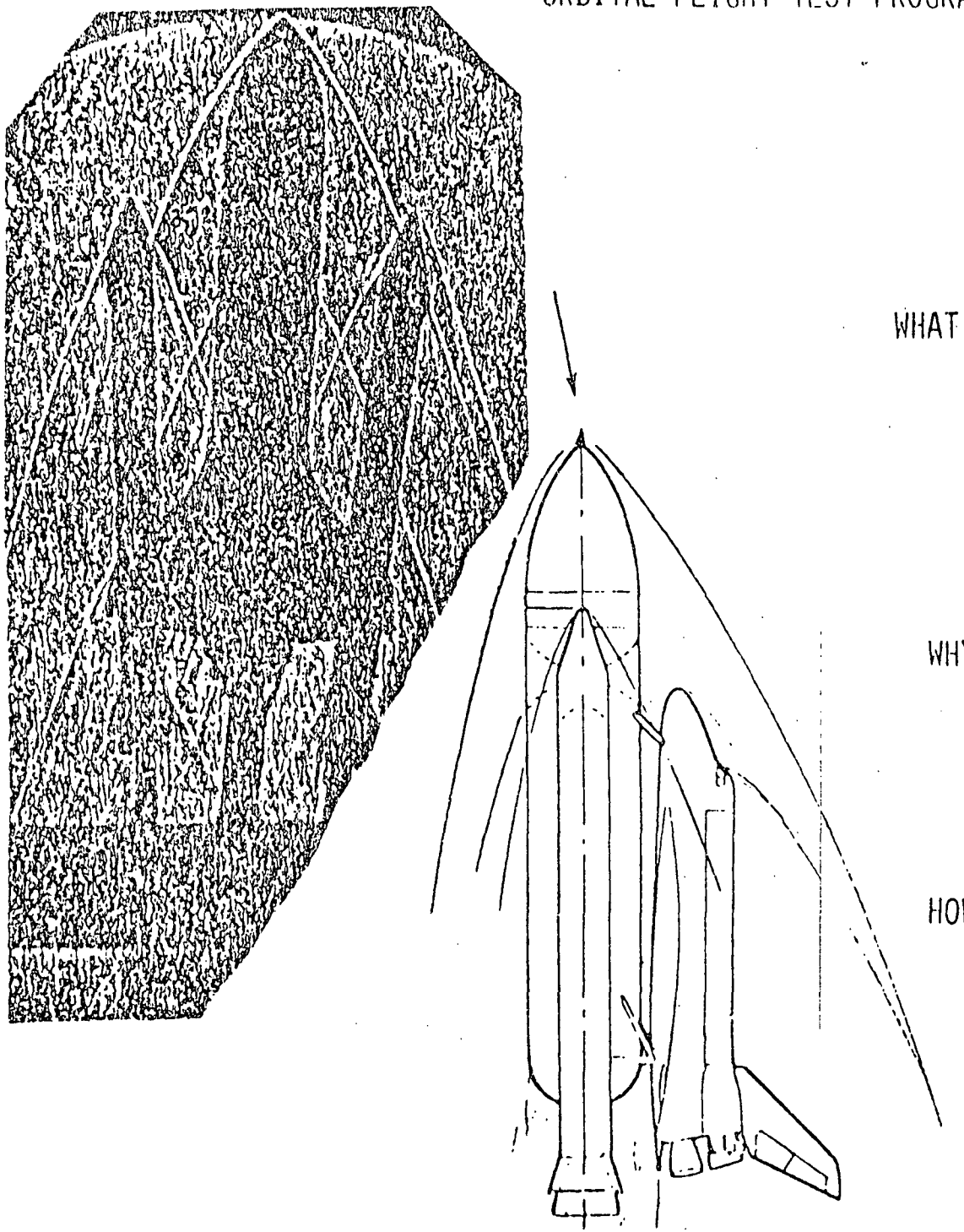
D = DATA COLLECTION ONLY (NO SPECIAL CREW OR VEHICLE ACTIVITY)

W-6

ASCENT FLIGHT TESTS

DATA COLLECTION	1	2	3	4	POST OFT
O ASCENT AERODYNAMICS/FLIGHT CONTROL	X	X	X	X	X
O LAUNCH VEHICLE POWER-ON BASE DRAG	X	X	X	X	
O ASCENT AERO HEATING	X	X	X	X	
O POGO	X	X	X	X	X
O LOADS, ACOUSTICS, VIBRATION	X	X	X	X	X
O FLUTTER, BUFFET	X	X	X	X	
O MPS PERFORMANCE	X	X	X	X	X
O OMS PERFORMANCE	X	X	X	X	
O SRB & ET PERFORMANCE & SYSTEMS	X	X	X	X	
O CONTAMINATION MONITORING	X	X	X	X	
O PAYLOAD ENVIRONMENT	X	X	X	X	
O COMMUNICATIONS AND TRACKING	X	X	X	X	
O THERMAL CONTROL SYSTEM PERFORMANCE	X	X	X	X	
O ELECTRICAL POWER	X	X	X	X	
O ENVIRONMENTAL CONTROL	X	X	X	X	
O GUIDANCE/NAVIGATION PERFORMANCE	X	X	X	X	
ACTIVITY TEST					
O FLUTTER BOUNDARY EVALUATION (PTI'S FROM 40 TO 2000 FPS)		X	X	X	
O UHF TEST (TRANSMISSION THRU PLUME)	X	X			

ORBITAL FLIGHT TEST PROGRAM



ASCENT HEATING

WHAT
- O FLOW FIELD DYNAMICS & LOCALIZED HEATING
- O ET HEATING AT HIGH ALTITUDES
- O BOATTAIL CIRCULATION & CONVECTIVE HEATING

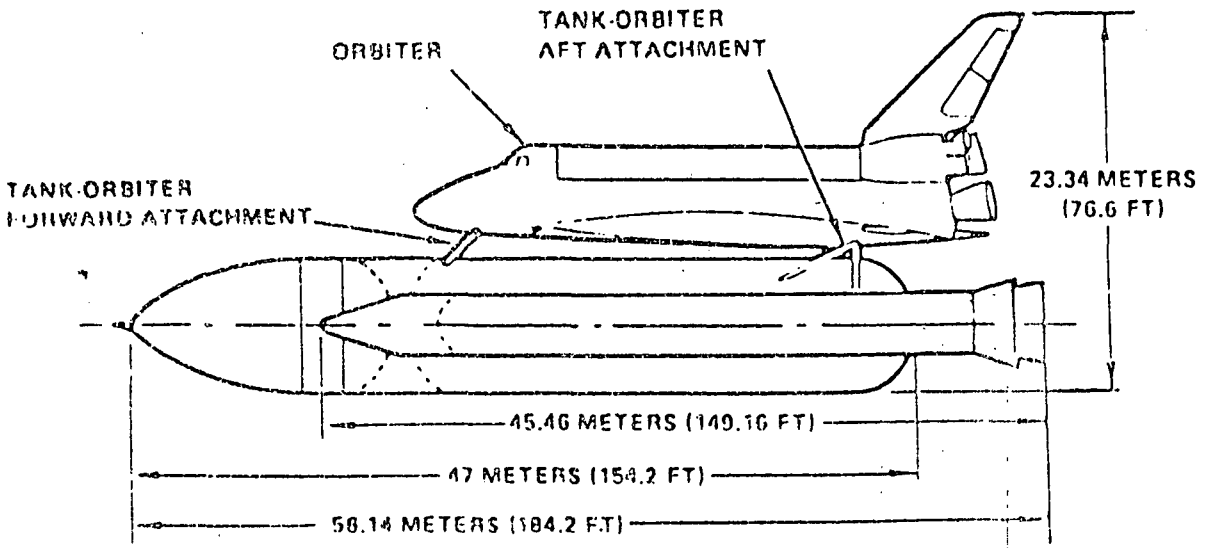
WHY
- O ADEQUACY OR MARGIN OF TPS DESIGN
- O ET BREAKUP ANALYSES INPUTS
- O WEIGHT OR DESIGN IMPROVEMENT CHANGES

HOW
- O VARIATIONS IN TRAJECTORY LOFTING
- O CHANGES IN MECO ALTITUDE
- O DIFFERENT SRB SEPARATION ALTITUDES
- O THROTTLING PROFILE CHANGES

W-B

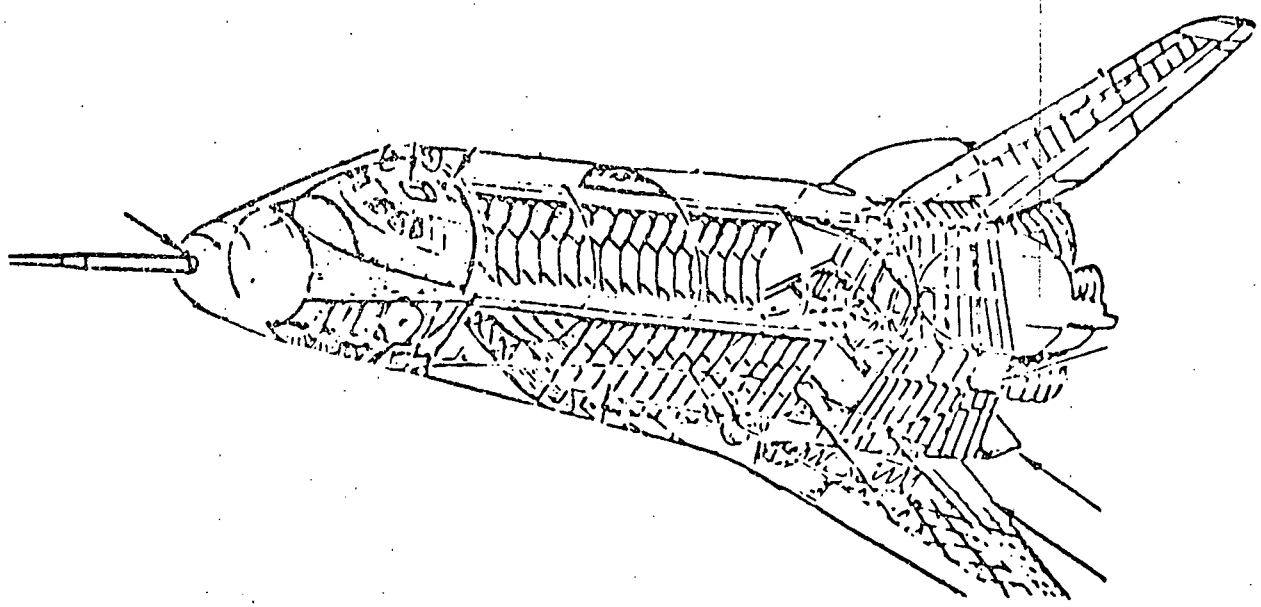
JOB NO.
CHKD. BY DATE

ORBITAL FLIGHT TEST PROGRAM



ASCENT LOADS

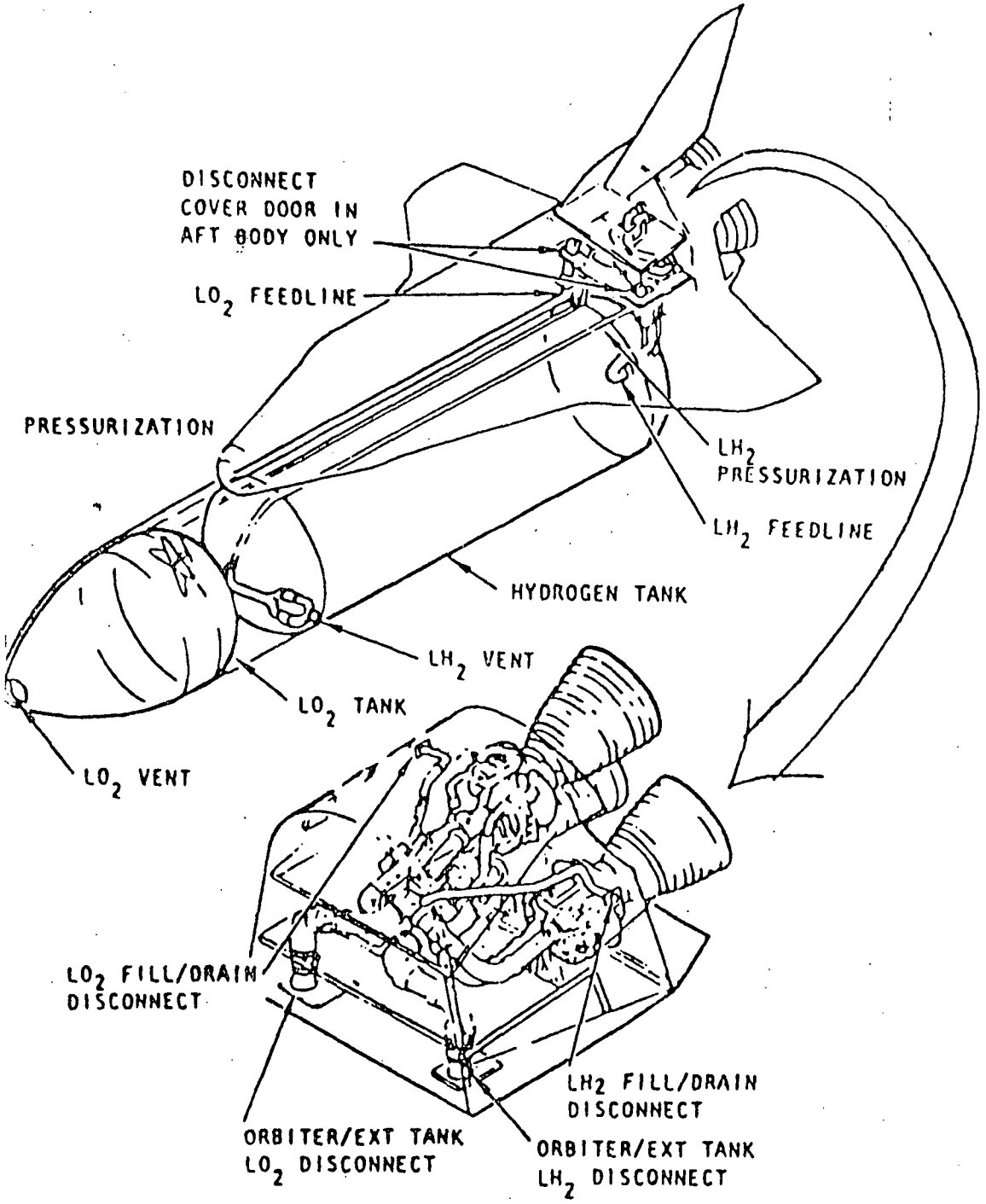
- O SRB TO ET LOADS
- O ET TO ORBITER STRUT LOADS
- O DYNAMIC RESPONSES



ORBITER INTERNAL LOADS

- O STRUT LOADS DISSIPATION
- O WING LOADING
- O TAIL LOADING
- O PAYLOADS DYNAMICS

ORBITAL FLIGHT TEST PROGRAM



POGO IS A DYNAMIC INTERACTION OF THE TOTAL PROPELLANT FLOW SYSTEM IN RESPONSE TO FLIGHT CONDITIONS (INCLUDING VEHICLE DYNAMICS) WHICH IN TURN CAN CAUSE INSTABILITY IN ENGINE PERFORMANCE.

FLIGHT TEST VERIFIES THE DESIGN OF THE ORBITER/ET PROPELLANT FLOW SYSTEM AND POGO SUPPRESSORS TO HAVE WIDE PERFORMANCE MARGINS IN TERMS OF POGO SUSCEPTIBILITY.

ORBITAL FLIGHT TEST PROGRAM

ENVIRONMENT CHARACTERIZATION

WHAT	HOW MEASURED
ACOUSTICS	MICROPHONES ON OSTA, DFI, AND ORBITER
VEHICLE FLEXING	STRAIN GAGES/VISUAL - ORBITER
FREE PARTICULATES	PHOTO - STERO - IECM
OUTGASSING	QUARTZ CRYSTAL MICROBALANCES - IECM
	GAS SAMPLES _ IECM
	MASS SPECTOSCOPY - IECM
	SAMPLE ARRAY - IECM
THERMAL	TEMPERATURE MEASUREMENTS - ORBITER
VIBRATION	ACCELEROMETERS - OSTA, DFI, ORBITER
SHOCK, DYNAMICS	ACCELEROMETERS - OSTA, DFI, ORBITER

WHY - DEFINE THE REAL PAYLOAD BAY ENVIRONMENT FOR THE ANALYSIS OF PAYLOADS RESPONSES AND FOR THE DESIGN OF FUTURE PAYLOADS.

ON-ORBIT FLIGHT TESTS

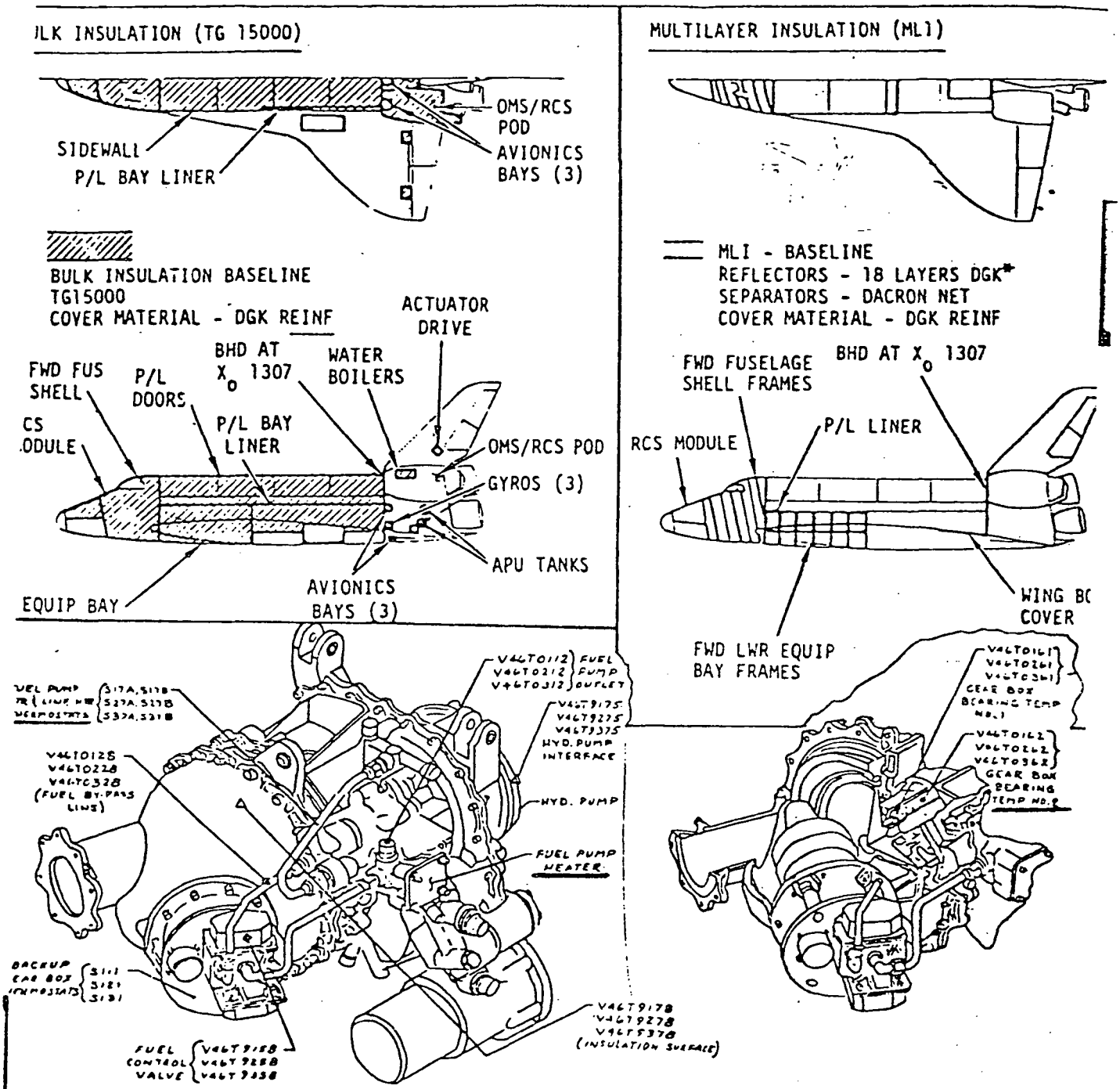
DATA COLLECTION	1	2	3	4	POST OFT
THERMAL CONTROL SYSTEMS	X	X	X	X	X
POGO STABILITY (OMS)	X	X	X	X	
ELECTRICAL POWER SYSTEM	X	X	X	X	
CONTAMINATION MONITORING	X	X	X	X	
PAYLOAD BAY ENVIRONMENT	X	X	X	X	
ENVIRONMENTAL CONTROL SYSTEMS	X	X	X	X	
CABIN NOISE	X	X	X	X	X
COMMUNICATIONS AND TRACKING	X	X	X	X	X
GUIDANCE/NAVIGATION PERFORMANCE	X	X	X	X	
RENDEZVOUS SYSTEMS					X
FLIGHT CONTROL/HYDRAULICS	X	X	X	X	

ACTIVITY TESTS

SUMMARIZED ON FOLLOWING CHARTS

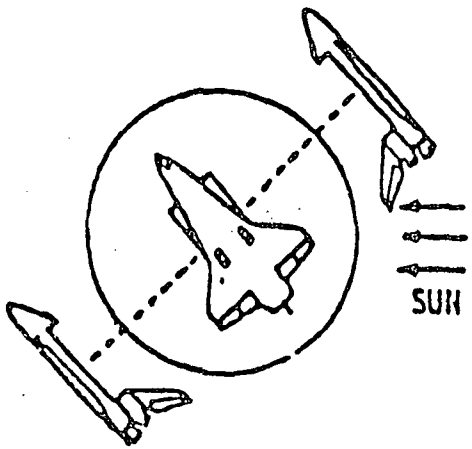
THERMAL CONTROL SYSTEMS

SIS-1	SIS-2	SIS-3	SIS-4	POST OFT
+ZLV, X-POP TAIL TO SUN	+ZLV, 88 HRS	PTC 10 HRS 6/3, 6/3, 6/10, 34 HRS -X SI, 80 HRS +Z SI, 26 HRS	PTC, 10 HRS +X SI, 80 HRS -Z SI, 40 HRS PTC, 10 HRS +Z SI, 20 HRS	HI BETA, +Y SI ATTITUDES, (EQUIP NOT AVAILABLE IN OFT, LACK OF TEST TIME)
BENIGN CONDITIONS FOR BASELINE DATA	BENIGN CONDITIONS (ATTITUDE TO SUPPORT OSTA-1)	-THERMAL STABILIZ -COLD BONDLINE CONSTRAINT, DEEP SPACE VIEWING, COLD PAYLOAD ATTACHMENTS -COLD MID + AFT FUSELAGE, OMS, HYDRAULICS AND MLG -OMS DUTY CYCLE -ARCS SOAKBACK -STARTRACKER FLASH EVAP AND WATER FEEDLINE HOT	-THERMAL STABILIZ -COLD FRCS, MLG, STARTRACKER AND HYDAULICS -WARM BOTTOM STRUCTURAL RECOVERY -FRCS SOAKBACK -ARCS SOAKBACK -POTABLE AND WASTE WATER LINES -FLASH EVAP AND WATER FEEDLINE COLD	-OMS PROP LINES -OMS HTRS, HYD SYSTEM & MLG -KU-BAND SYSTEM -COLD BONDLINE CONSTRAINTS -PAYLOAD BAY CONDITIONS -RCS SOAKBACKS -AIRLOCK -PAYLOAD BAY KIT -LONG DURATION OMS BURN

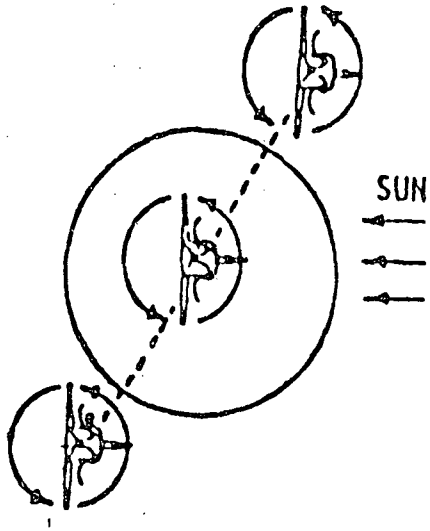


- HEAT PATHS/HEAT SHORTS
- HEATER ADEQUACY
- THERMOSTAT SET POINTS

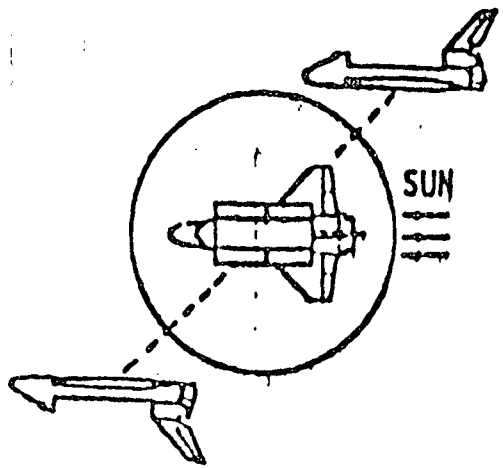
*DEPOSITION GOLD ON KAPTON



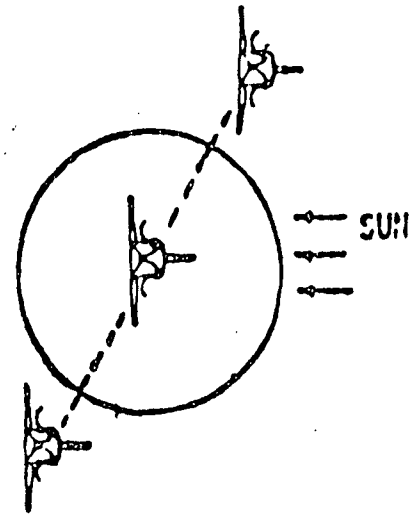
TOP TO EARTH (+Z LV)



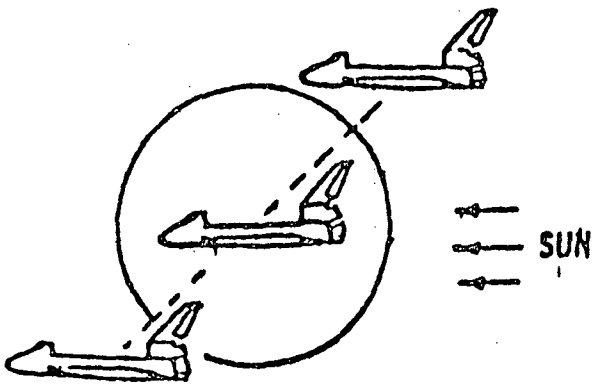
PASSIVE THERMAL CONTROL (PTC)



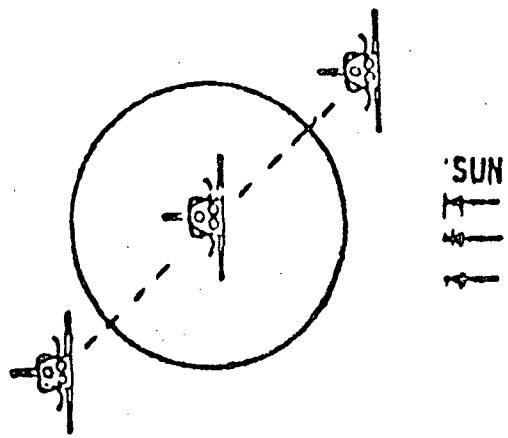
TAIL TO SUN BOTTOM TO EARTH
ORBITAL RATE (6/3, 6/3, 6/10)



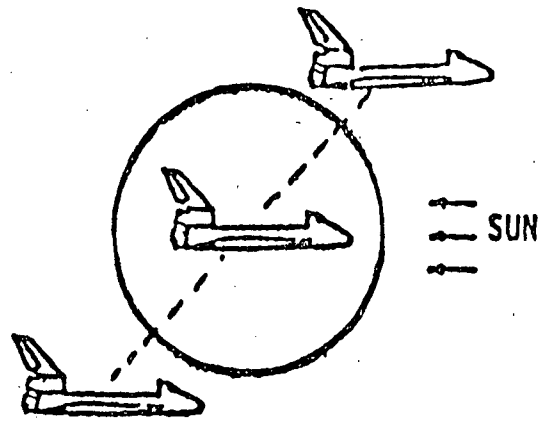
TOP TO SUN (+Z SI)



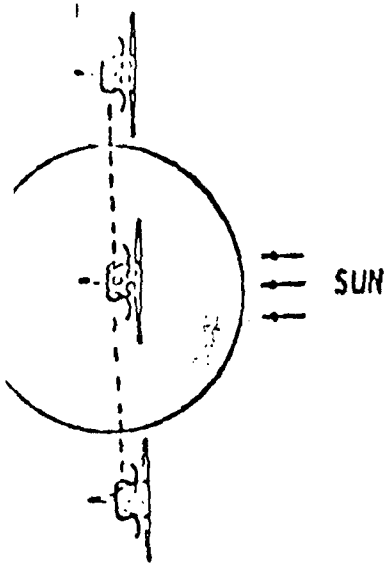
TAIL TO SUN (+X SI)



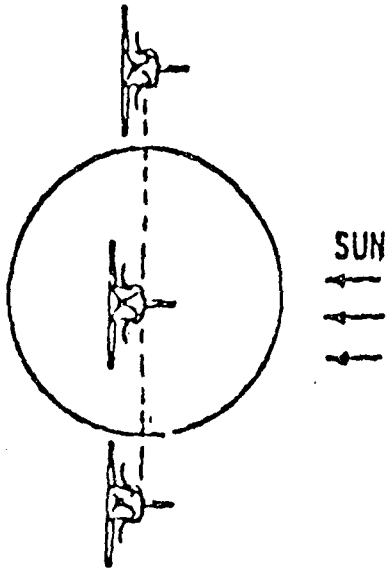
BOTTOM TO SUN (-Z SI)



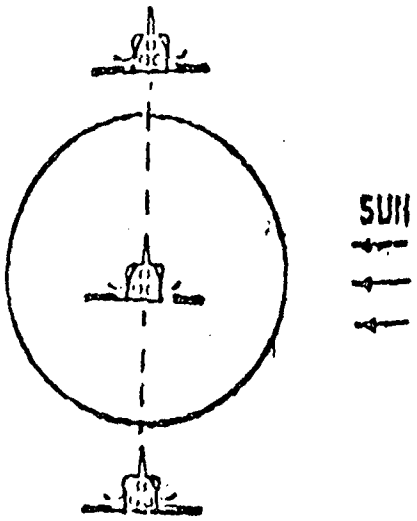
NOSE TO SUN (-X SI)



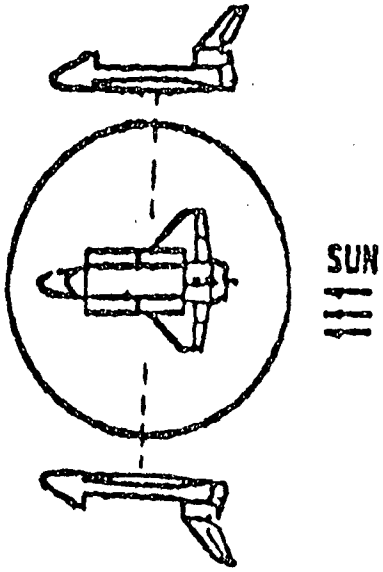
BOTTOM TO SUN (-Z SI)
< 73° BETA



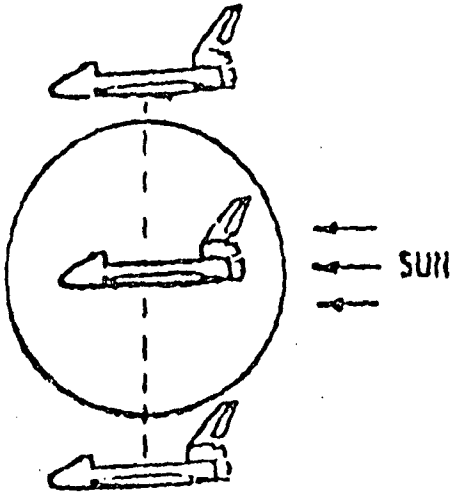
TOP TO SUN (+Z SI)
> 73° BETA



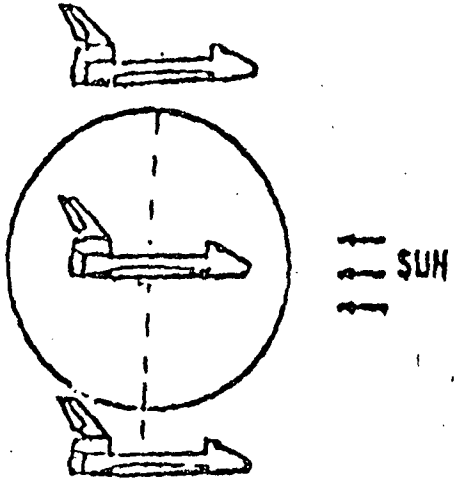
SIDE SUN (+Y SI)
> 73° BETA



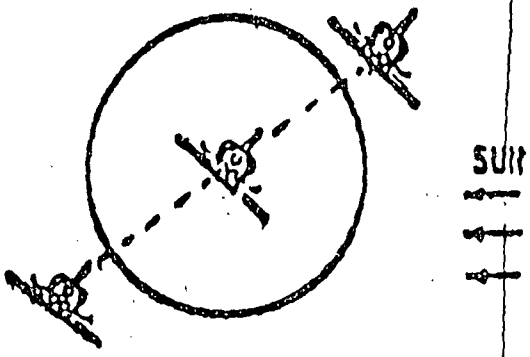
BOTTOM TO EARTH ORBITAL RATE
(6/3, 6/3, 6/10) > 73° BETA



TAIL TO SUN (+X SI)
> 73° BETA



NOSE TO SUN (-X SI)
> 73° BETA



SIDE SUN (+Y SI) ROLLED RIGHT 40°
< 46° BETA

ORBITAL FLIGHT TEST PROGRAM

ON-ORBIT TESTS

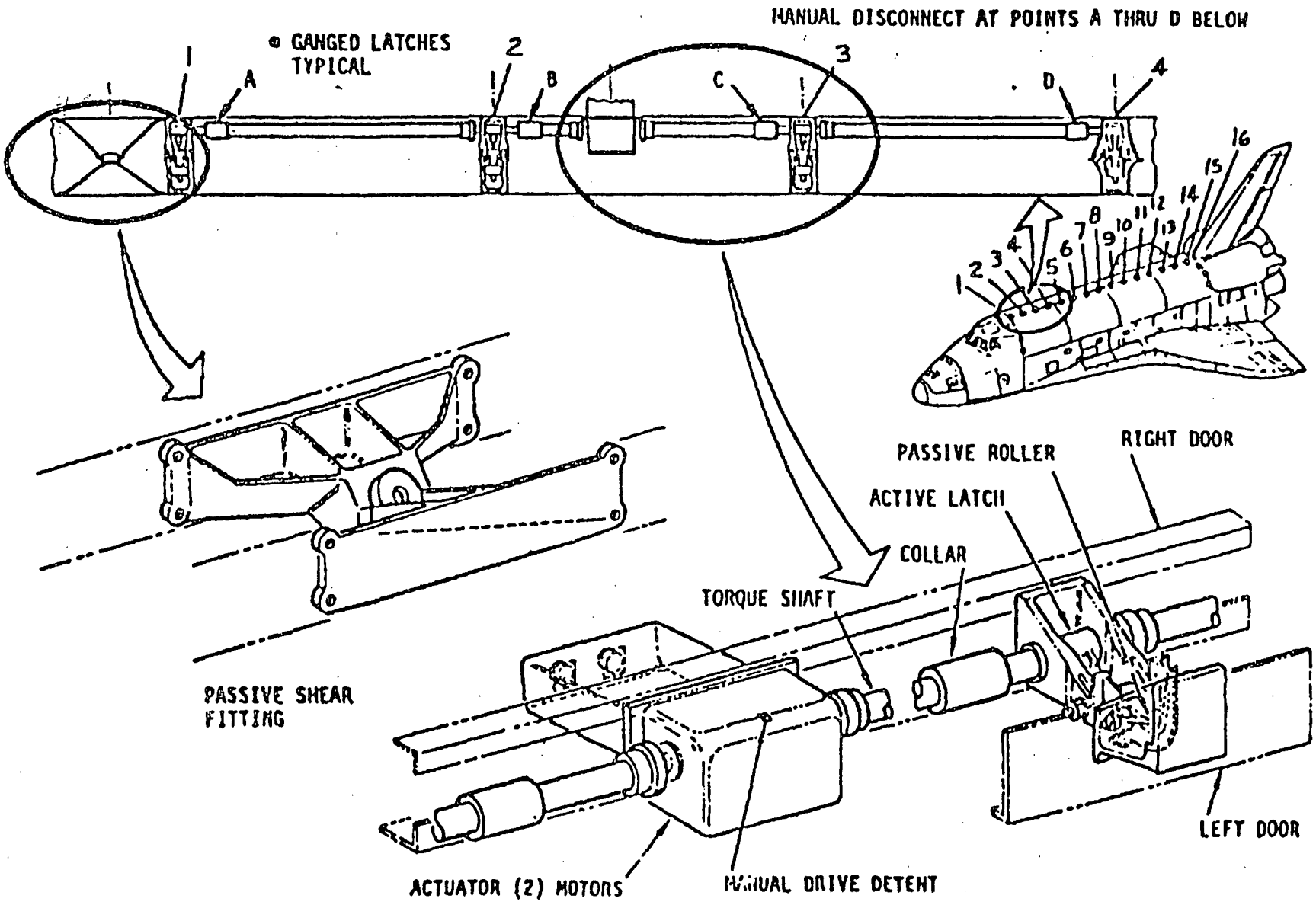
YLOAD BAY DOOR TESTS

STS-1	STS-2	STS-3	STS-4	POST OFT
Latch tests Opening & closing test Radiator deploy PLBD cycle test after 12 hrs of PTC or +Z LV Radiator stowing/ door closing	• Latch tests • PLBD cycle after 88 hrs +Z LV	• PLBD cycle after 24 hrs 6/3,6/3,6/10 • PLBD cycle after 80 hrs -X SI • PLBD cycle after 26 hrs +Z SI	• PLBD cycle after 80 hrs +X SI • PLBD cycle after 40 hrs -Z SI	• PLBD cycle after 40 hrs +Y SI

'AYLOAD DEPLOYMENT AND RETRIEVAL SYSTEM

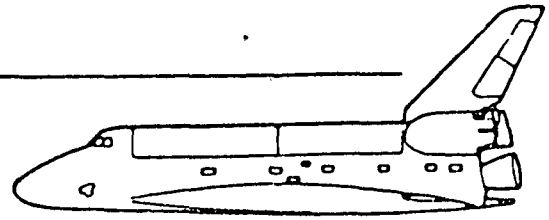
STS-1	STS-2	STS-3	STS-4	POST OFT
• RMS	• Unloaded arm tests - - Cycle MPM,MRL - RMS direct,backup, single,manual, auto and operator commanded auto modes	• Loaded arm tests with PFTA - - Retention mech. - Extraction/stowing - Manual,auto,opr cmd,direct,backup, and single modes with PFTA - RMS envir. test - Capture dynamics • RMS use with ILCM (contam. monit.)	• RMS use with IECM (plume impingement)	• Deploy P/L • Retrieve P/L • Max Weight P/L • Max Vol. P/L

PAYLOAD BAY DOOR CENTERLINE LATCH SYSTEM



VERIFICATION OF DOOR OPERATIONS UNDER VARIED THERMAL CONDITIONS

ORBITER MECHANICAL SUBSYSTEMS



VENT DOOR MECHANISMS
(BOTH SIDES)

RUDDER/SPEED BRAKE
HYDRO-MECHANICAL
ACTUATION

MANIPULATOR
(OPTIONAL)

AFT ET SEPARATION
- STRUCTURE DISCONNECT
- SYSTEMS DISCONNECT
- SEPARATION SYSTEM CLOSEOUT DOOR

PAYLOAD
RETENTION

PAYLOAD BAY DOOR
ACTUATION AND LATCHING

MANIPULATOR

BODY FLAP HYDRO-
MECHANICAL ACTUATION

CREW TRANSFER TUNNEL KIT

EMERGENCY EGRESS
HATCH MECHANISMS

ELEVON SERVO AND
SURFACE ACTUATORS

CREW INGRESS/EGRESS HATCH
MECHANISM (LH SIDE)

STARTRACKER DOOR

YAW AND BRAKE
CONTROL PEDALS

MAIN GEAR
- WHEELS AND TIRES
- BRAKES
- ANTISKID

MANIPULATOR
DEPLOY AND JETTISON

RENDEZVOUS
SENSOR
DEPLOYMENT

FORWARD ET
SEPARATION

DEPLOYABLE
AIR DATA SENSOR
(BOTH SIDES)

NOSE GEAR
- WHEELS AND TIRES
- STEERING/DAMPING

- SOFTWARE/HARDWARE PERF.
- BRAKING
- PAYLOAD/ARM DYNAMICS
- DEPLOY/RETRIEVE AGILITY
- PROXIMITY OPERATIONS

VERIFICATION OF PAYLOAD DEPLOYMENT AND RETRIEVAL SYSTEMS OPERATIONS

ON-ORBIT FLIGHT TESTS

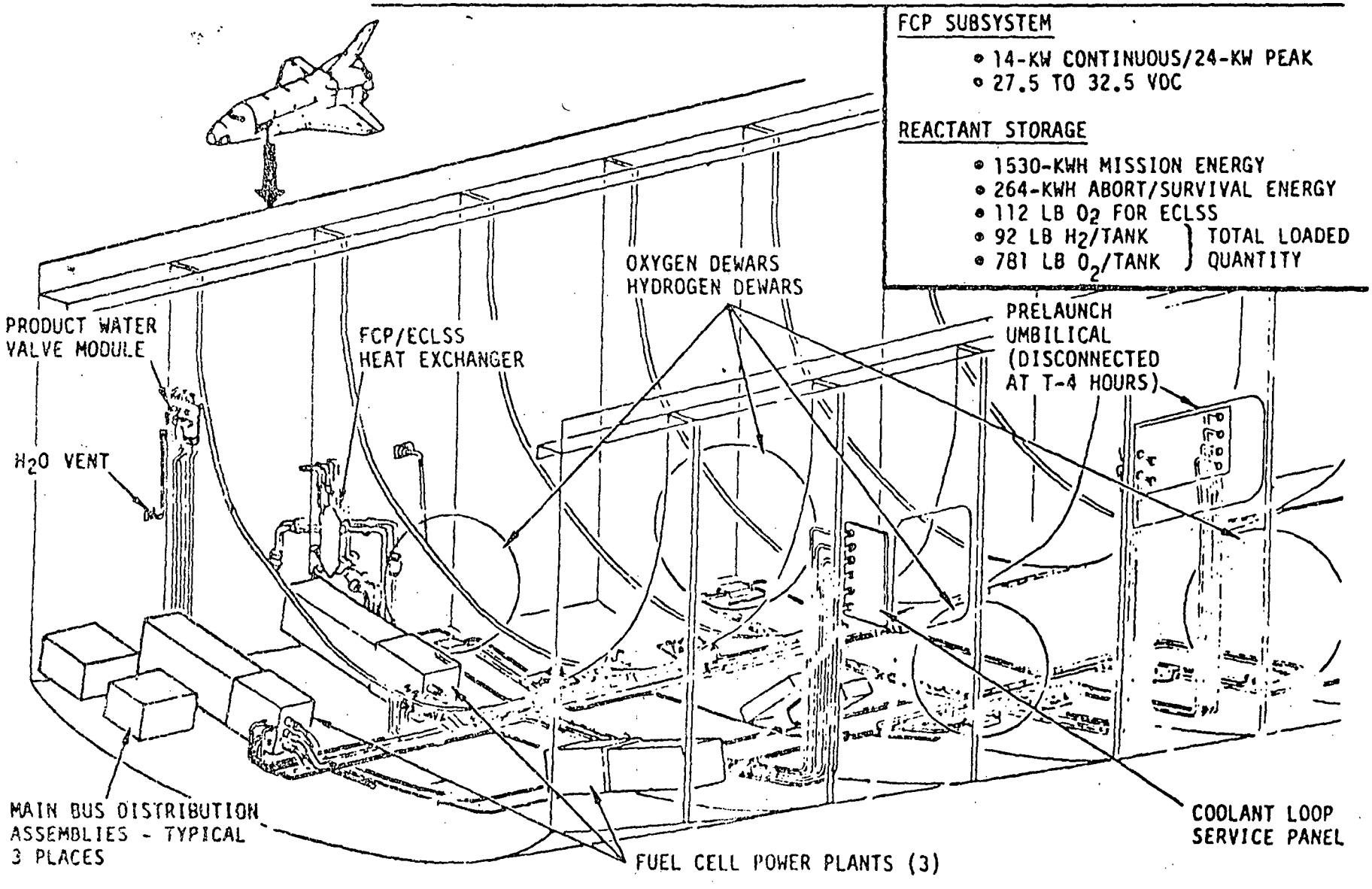
ENVIRONMENTAL/TEMPERATURE/POWER SYSTEMS

STS-1	STS-2	STS-3	STS-4	POST OFT
O RADIATOR HEAT SINK CAPABILITY, ON-ORBIT	O RADIATOR HEAT SINK CAPABILITY DURING ENTRY O PRSD PERF - HIGH LOAD ON FC'S AT FULL, HALF AND MIN QUANTITY, WITH 'STIRRING' (EFFECTS OF STRATIFICATION)	O RADIATOR HEAT SINK CAPABILITY ON-ORBIT, COLD CASE O ATCS TESTS IN VARIOUS ATTITUDES O FLASH EVAP, AND HIGH DUCT STEAM FLOW TESTS IN -X SI O CRYO TANK HEAT LEAK DEMO - -X SI, COLD PERIOD +Y SI, WARM PERIOD	O ECLSS TEST- LOW CABIN HEAT LOAD FOR 24 HRS IN +X SI	O RADIATOR HEAT SINK CAPABILITY WITH LARGE PAYLOAD

ORBITAL FLIGHT TEST PROGRAM

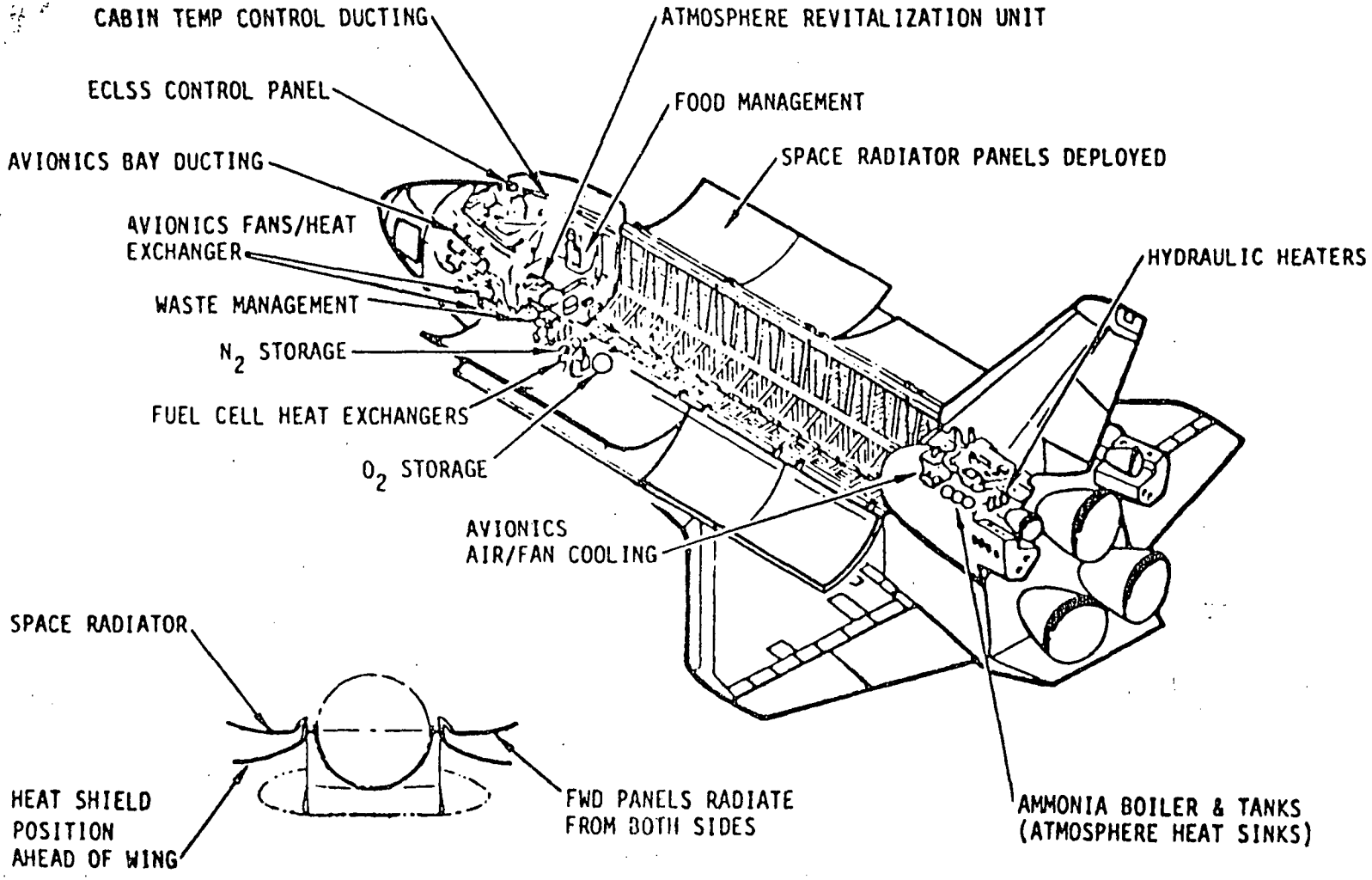
ORBITER ELECTRICAL POWER SUBSYSTEM

BASELINE CONFIGURATION


FCP SUBSYSTEM
• 14-KW CONTINUOUS/24-KW PEAK
• 27.5 TO 32.5 VDC
REACTANT STORAGE
• 1530-KWH MISSION ENERGY
• 264-KWH ABORT/SURVIVAL ENERGY
• 112 LB O_2 FOR ECLSS
• 92 LB H_2/TANK } TOTAL LOADED
• 781 LB O_2/TANK } QUANTITY
OXYGEN DEWARS
HYDROGEN DEWARS
PRODUCT WATER VALVE MODULE
FCP/ECLSS HEAT EXCHANGER
PRELAUNCH UMBILICAL (DISCONNECTED AT T-4 HOURS)
H_2O VENT
MAIN BUS DISTRIBUTION ASSEMBLIES - TYPICAL 3 PLACES
FUEL CELL POWER PLANTS (3)
COOLANT LOOP SERVICE PANEL

ZERO "G" STRATIFICATION, HIGH LOAD, HEAT LEAK, ETC. TESTING

ORBITER ENVIRONMENTAL CONTROL AND LIFE SUPPORT SUBSYSTEM



THERMAL/VACUUM, ZERO "G" FLIGHT DYNAMICS, & REAL THERMAL LOADS EFFECTS ON SYSTEM PERFORMANCE

ORBITAL FLIGHT TEST PROGRAM

COMMUNICATIONS AND TRACKING

STS-1	STS-2	STS-3	STS-4	POST OFT
O S-BAND PM AND FM TEST	O ANTENNA SWITCHING TEST	O CCTV	O DATA ONLY	O S-BAND TDRS TEST
O UHF ON-ORBIT TEST	O CCTV	O DATA ONLY FOR OTHER SYSTEMS		O KU-BAND TESTS
O CCTV				O RENDEZVOUS RADAR TESTS
				O PAYLOAD COMM
				O AIR FORCE COMM

GUIDANCE/NAVIGATION TESTS

STS-1	STS-2	STS-3	STS-4	POST OFT
O ACCEL CAL	O AFT COAS CAL VERIF	O AFT COAS CAL	O ST PARTICLE INTERFERENCE	O GLOBAL POSITIONIN SATELLITE TESTS
O IMU DRIFT	O AFT COAS IMU ALIGN VERIF	O FWD COAS CAL	O NAV BASE STAB +X SI	O RENDEZVOUS SYSTEMS TESTS
O AFT COAS CAL VERIF	O FWD COAS CAL VERIF	O FWD COAS CAL VERIF		
O AFT COAS IMU ALIGN VERIF	O FWD COAS IMU ALIGN VERIF	O FWD COAS IMU ALIGN VERIF		
O ST IMU ALIGN VERIF	O ST IMU ALIGN VERIF	O NAV BASE STAB +Z SI		
O ST SUN, EARTH HORIZ TEST	O ST WITHIN 10^{o}-20^{o} OF HORIZ			
O ST IMU ALIGN WHILE ROLLING	O ST TO IMU ALIGN			
	O IMU TO IMU ALIGN			

ORBITAL FLIGHT TEST PROGRAM

ORBITAL MANEUVERING SYSTEM TESTS

	FLIGHT, BURN TIME, ENGINE									
	STS-1		STS-2		STS-3		STS-4		POST OFT	
	L.ENG	R.ENG	L.ENG	R.ENG	L.ENG	R.ENG	L.ENG	R.ENG	L.ENG	R.ENG
20 HRS. -X SI THERMAL CONDITIONING NO CROSS FEED, L;ENG; 200 SEC									200	
ONE ENGINE, NO CROSSFEED, 200 SEC									200	200
SIMULATED ENGINE FAILURE, AUTO, CROSSFEED			10	40						
SIMULATED ENGINE FAILURE, MTVC							10	40		
BACKUP FLIGHT SYSTEM, TWO ENGINES					30	30				
BACKUP FLIGHT SYSTEM, ONE ENGINE, COMBINED WITH LOW TEMP, RESTART					32					
ENGINE RESTART			20							
20 HRS. -X SI THERMAL CONDITIONING PULSE MODE					8					
L.POD TO R.ENGINE CROSSFEED, MTVC	30									
R.POD TO L.ENGINE CROSSFEED, AUTO		30								
TOTAL ON ORBIT OMS TEST TIME	60		70		100		50		600	
PROPELLANT REQUIRED (19.2 LB/SEC)	1152		1344		1920		960		11,520	
OMS TO RCS INTERCONNECT TEST, LBS			1000							
TOTAL OMS TEST PROPELLANT, LBS	1152		2344		1920		960		12,120	

ORBITAL FLIGHT TEST PROGRAM

FLIGHT CONTROL/RCS TESTS

STS-1	STS-2	STS-3	STS-4	POST OFT
O RCS/GN&C ATTITUDE TESTS	O RCS/GN&C TRANLATIONAL TEST O FLIGHT CONTROL WARM UP TEST O HYDRAULIC CIRC. PUMP TEST	O BACK-UP FLIGHT CONTROL SYSTEM TEST O ROTATION & TRANSLATION MANEUVER	O DATA ONLY	

CREW ACCOMMODATIONS

STS-1	STS-2	STS-3	STS-4	POST OFT
O NOISE LEVEL TEST O CABIN AIR SAMPLING	O NOISE LEVEL TEST O CABIN AIR SAMPLING O AIR LOCK/ENU PREP. DEMO	O DATA ONLY O CABIN AIR SAMPLING	O DATA ONLY O CABIN AIR SAMPLING	O NOISE LEVEL TEST O CABIN AIR SAMPLING O EVA DEMO O MMU EVAL O PRS EVAL

PROXIMITY OPERATIONS

STS-1	STS-2	STS-3	STS-4	POST OFT
				O STATION KEEPING O PASSIVE APPROACH O ACTIVE APPROACH

ENTRY FLIGHT TESTS

DATA COLLECTION	1	2	3	4	POST OFI
O THERMAL CONTROL SYSTEMS	X	X	X	X	X
O AERODYNAMICS/FLIGHT CONTROL	X	X	X	X	X
O ENTRY HEATING (AERO THERMAL DYNAMICS & TPS)	X	X	X	X	X
O LOADS AND STRESS (STRUCTURES)	X	X	X	X	
O FLUTTER AND BUFFET	X	X	X	X	
O TPS VERIFICATION	X	X	X	X	X
C CONTAMINATION MONITORING	X	X	X	X	
O ENVIRONMENTAL CONTROL	X	X	X	X	
O ELECTRICAL POWER	X	X	X	X	
O GUIDANCE/NAVIGATION PERFORMANCE	X	X	X	X	X
O COMMUNICATIONS AND TRACKING	X	X	X	X	
O AIR DATA SYSTEM	X	X	X	X	
O AUTOLAND	X	X	X	X	X
O MSBLS	X	X	X	X	
O TACANS	X	X	X	X	
O PAYLOAD BAY ENVIRONMENT	X	X	X	X	

ACTIVITY TESTS

SUMMARIZED ON FOLLOWING CHARTS

AERODYNAMIC TESTS

PURPOSE: TO OBTAIN FLIGHT DATA OF ORBITER RESPONSE TO INDUCED MOTION DURING DURING SELECTED CRITICAL ENTRY PERIODS TO EVALUATE AERODYNAMIC ELASTICITY, CONTROL SYSTEM EFFECTIVENESS, AND FLIGHT PERFORMANCE PARAMETERS. VERIFICATION OF WIND TUNNEL DATA AND REMOVAL OF INTERIM PLACARDS.

- STABILITY AND CONTROL DERIVATIVES REQUIRE MANEUVERS TO OBTAIN USEABLE DATA. MANEUVERS TO CONSIST OF AERO STICK INPUTS (ASI) AND PROGRAMMED TEST INPUTS (PTI'S) FOR SHORT DURATION PITCH, YAW, AND/OR ROLL DOUBLETS, (INVOLVING BOTH AERO SURFACES AND RCS SETS), AND PUSH OVER PULL UPS (POPU'S) OF FAIRLY LONG DURATION. BODY FLAP PULSES BY MANUAL OPERATION. ELEVON SCHEDULES PROGRAMMED BY I-LOADS.

- MID C.G.'S DURING OFT FLIGHTS

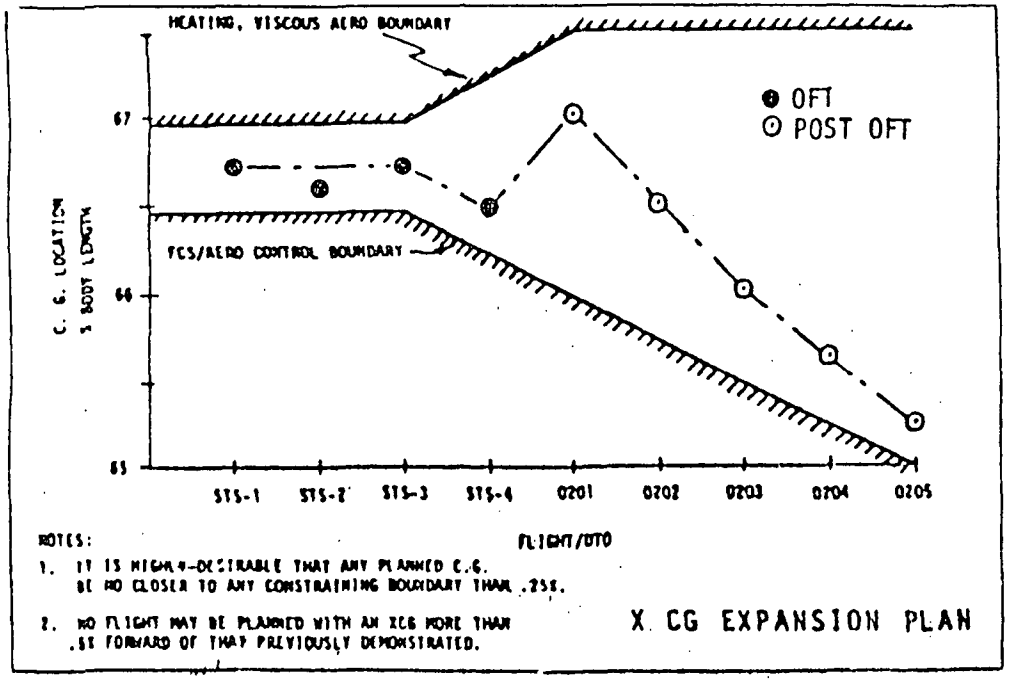
  ELEVON AND BODY FLAP DEFLECTION EFFECTS ON AERODYNAMIC CHARACTERISTICS ARE BASICALLY INDEPENDENT

  THEREFORE, AERODYNAMIC CHARACTERISTICS CAN BE DETERMINED WITH MID-C.G.'S (SAFE) USING DIFFERENT COMBINATIONS OF ELEVON AND BODY FLAP DEFLECTIONS THAT SPAN THE RANGE OF DEFLECTIONS FOR OPERATIONAL C.G. RANGE.

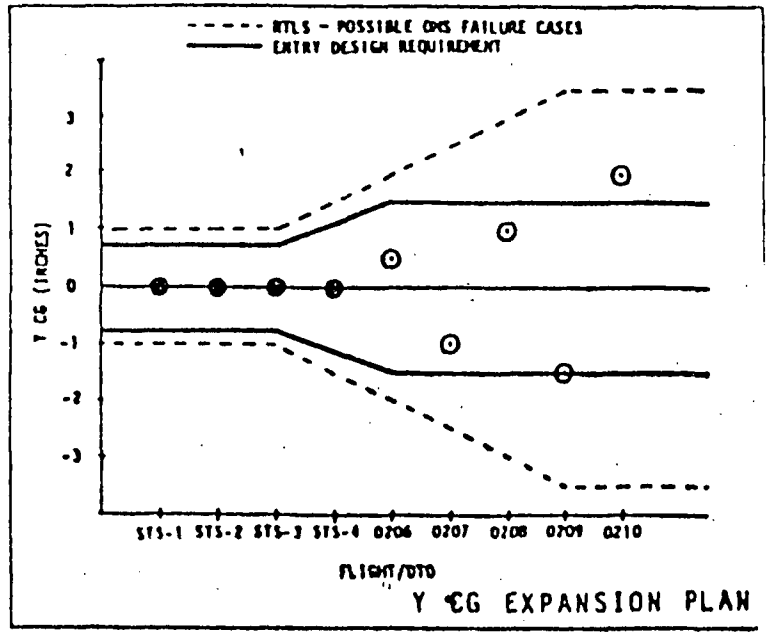
- EXTREME C.G.'S TO BE EVALUATED POST OFT

AERODYNAMIC DATA REQUIREMENTS

- HYPERSONIC LATERAL/DIRECTIONAL STABILITY
- HYPERSONIC VISCOUS AND REAL GAS PITCHING MOMENTS
- SUPERSONIC LATERAL/DIRECTIONAL STABILITY
- VEHICLE TRIM CHARACTERISTICS
- TRANSONIC HINGE MOMENTS
- TRANSONIC LATERAL/DIRECTIONAL STABILITY
- MACH 3.0 TO 4.5 LATERAL TRIM CAPABILITY
- MACH 0.9 RUDDER EFFECTIVENESS
- PUSHOVER-PULLUP PERFORMANCE, HEATING AND TRIM CHARACTERISTICS

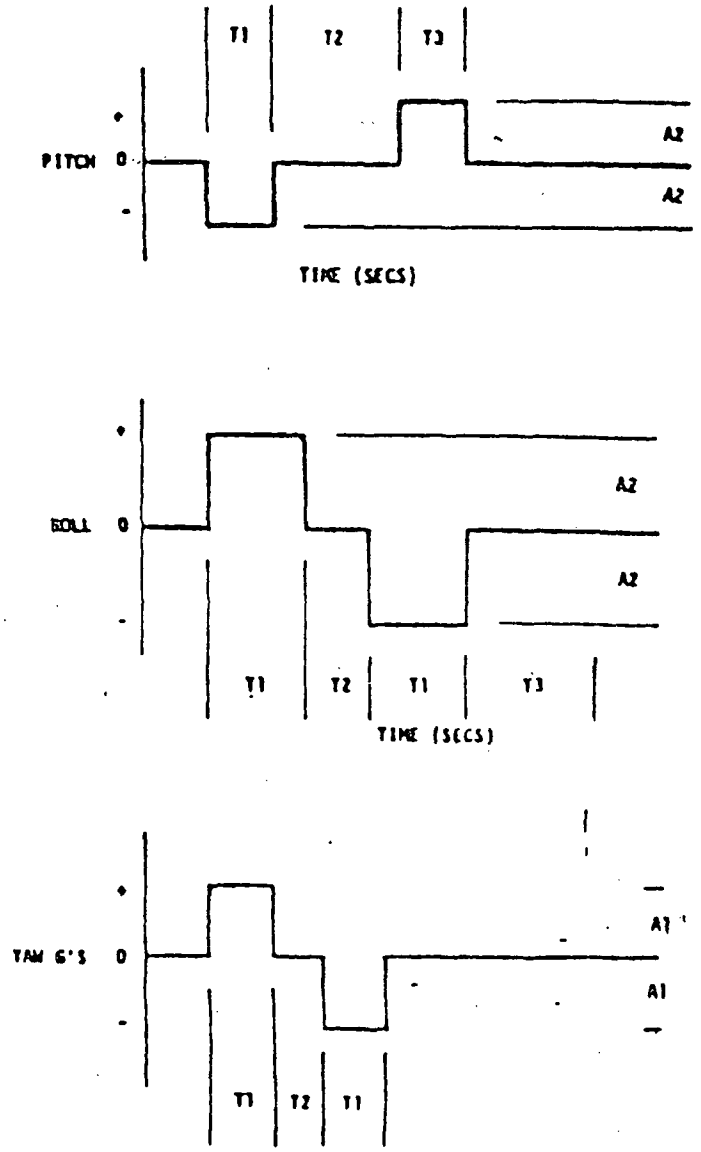


X CG EXPANSION PLAN

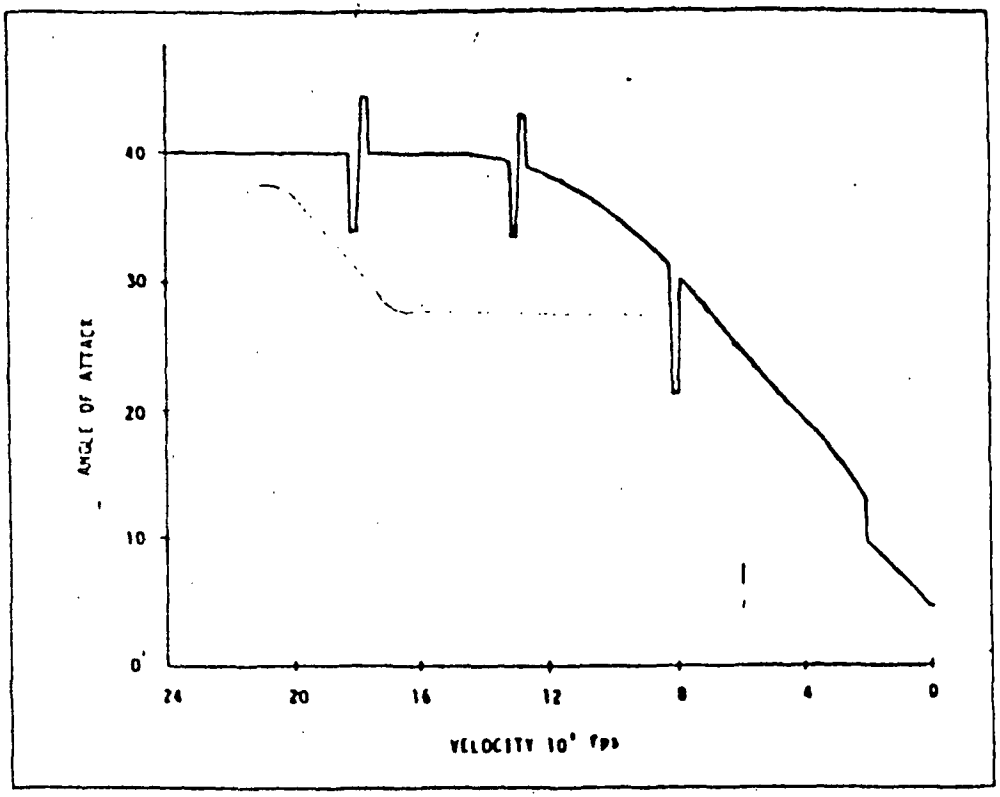


Y CG EXPANSION PLAN

OFT



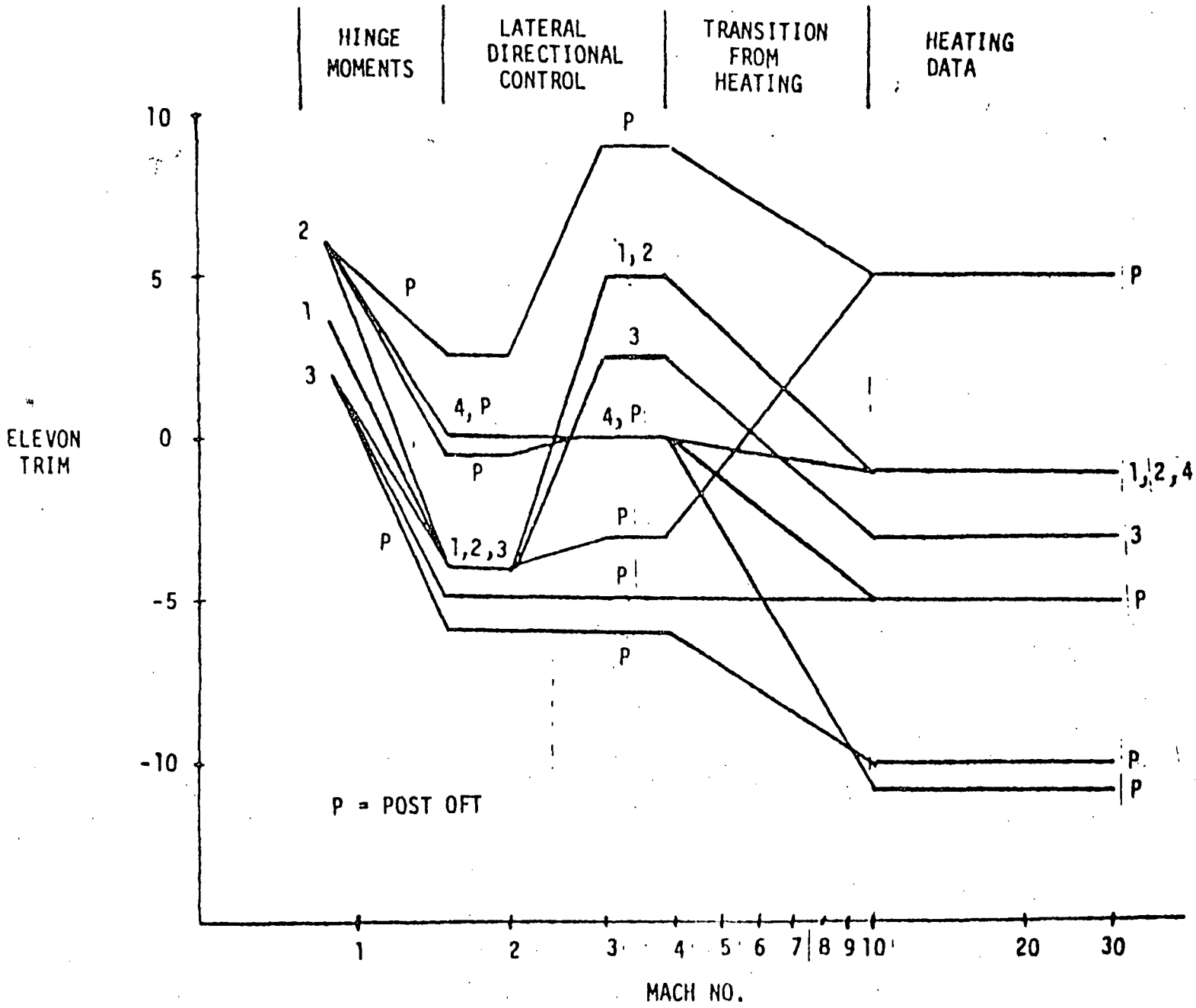
PTI COMMANDS (OR ASI'S)

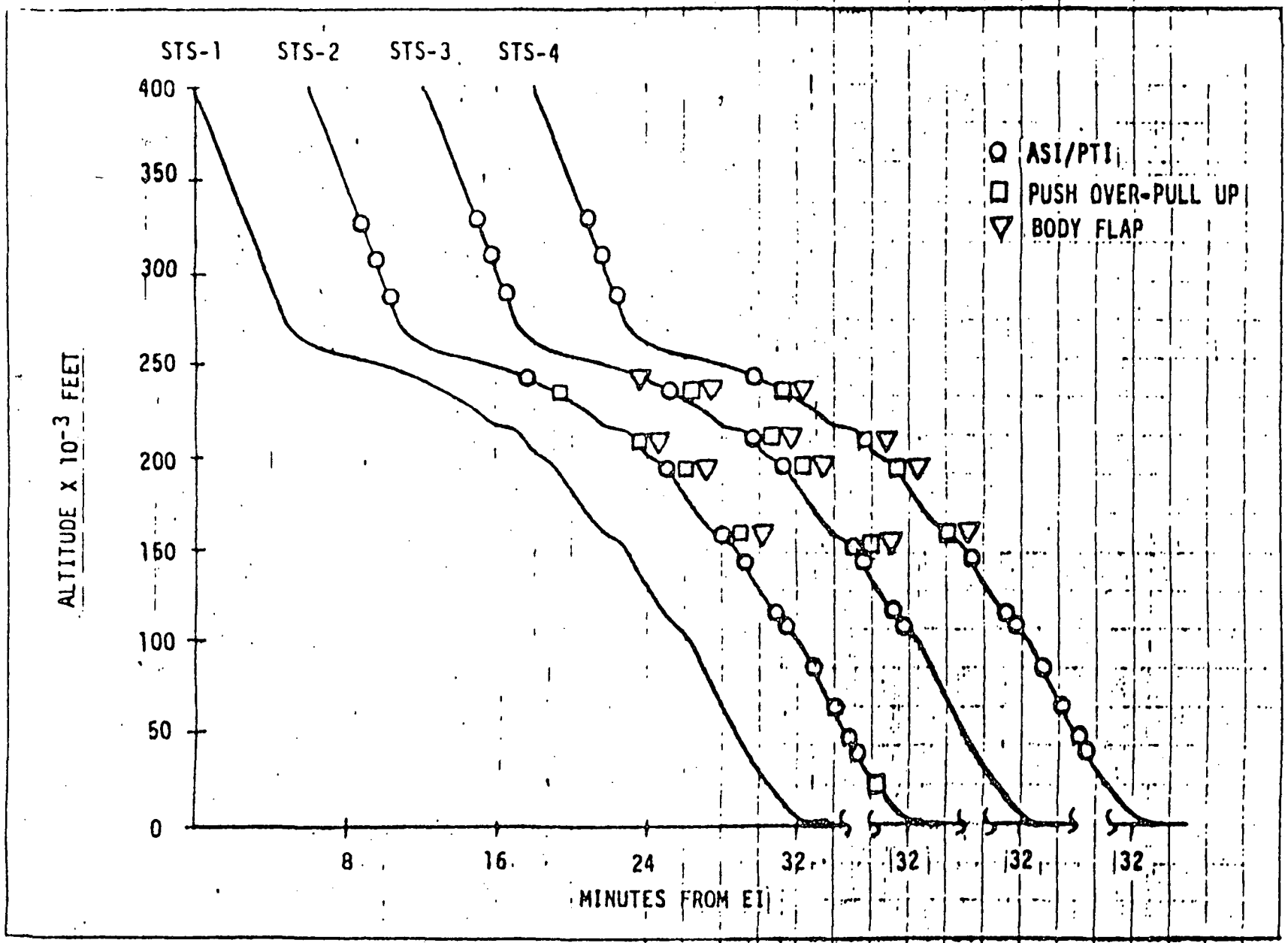


PUSHOVER - PULLUP SCHEDULE (TYPICAL)

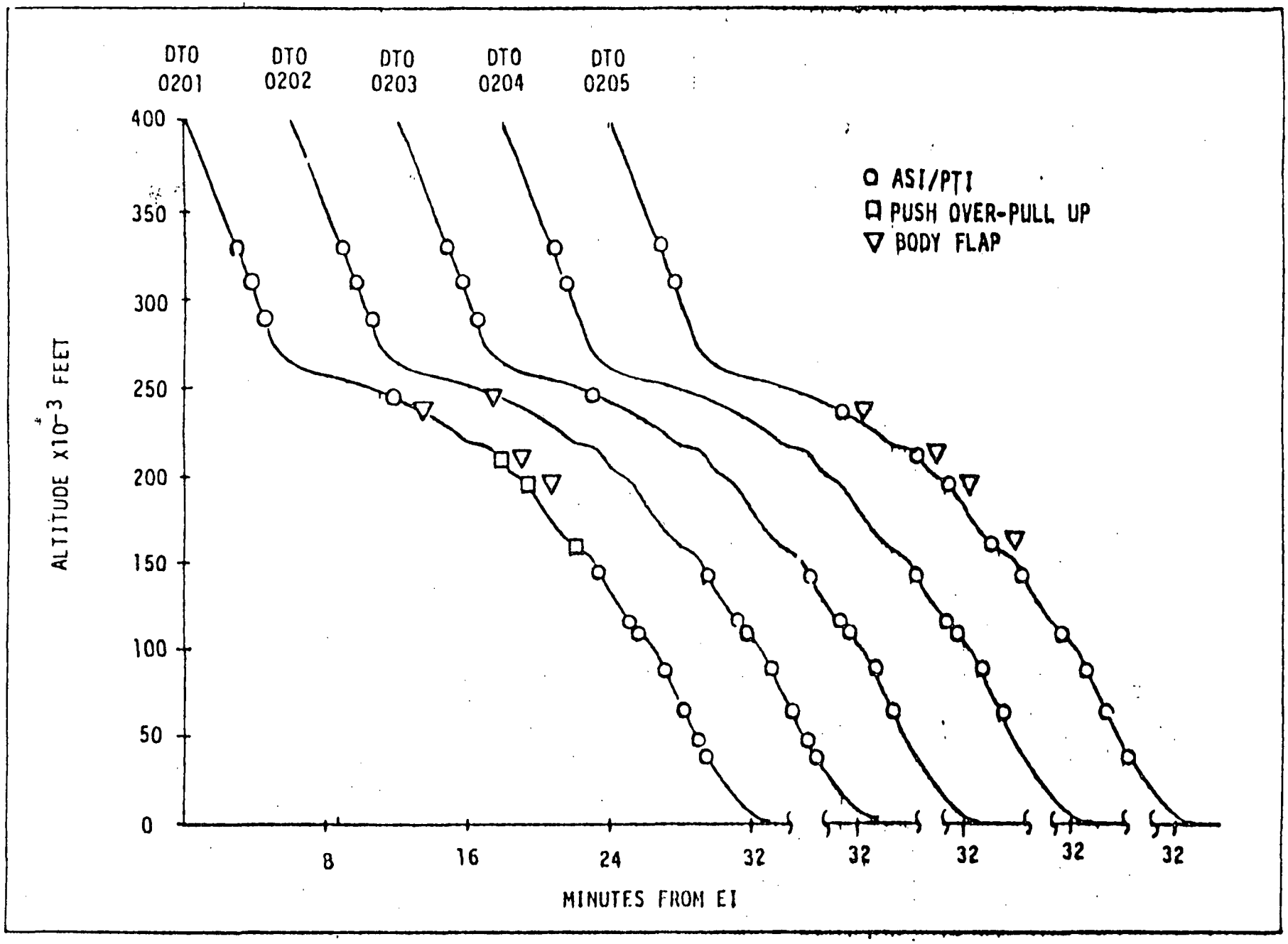
OFT

ELEVON SCHEDULES





OFT
AERODYNAMIC TESTS



POST OFT
AERODYNAMIC TESTS

OFT

ENTRY FLIGHT TESTS

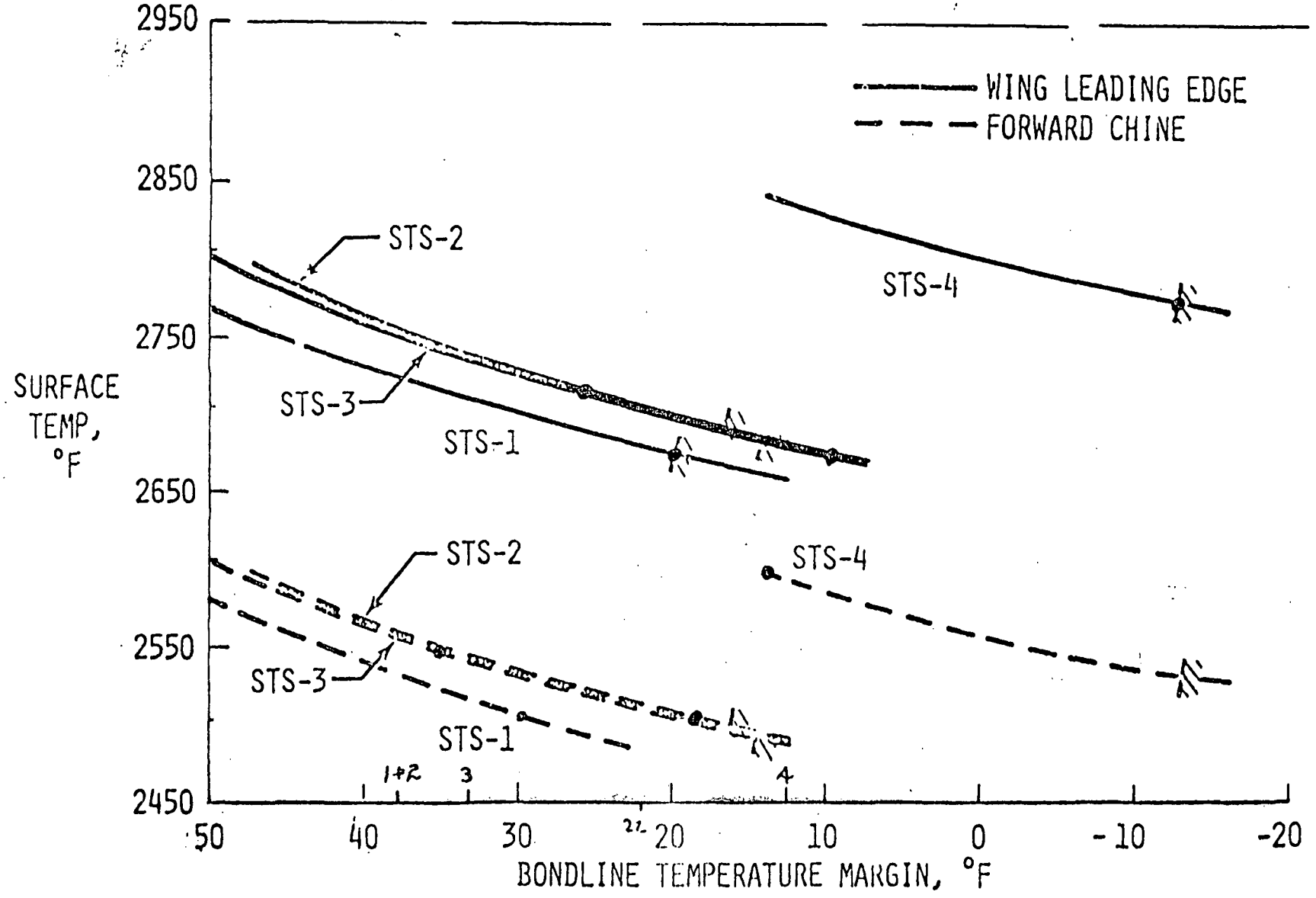
AEROTHERMODYNAMICS

- SHAPING GROUNDRULES:
  SHAPE TRAJECTORY TO SURFACE TEMPERATURE LIMITS WHICH DO NOT EXCEED SINGLE MISSION TPS MATERIAL CAPABILITY AND MINIMIZE PEAK BONDLINE TEMPERATURE.

- THERMAL CRITERIA FOR NOMINAL TRAJECTORY ESTABLISHED FROM:
  - TPS MATERIAL CAPABILITY/DESIGN LIMIT
    - SURFACE TERMPERATURE CAPABILITY
    - BONDLINE/STRUCTURAL TEMP LIMIT
  - STRUCTURAL DESIGN TEMP GRADIENT (TRAJ 14040)
  - UNCERTAINTY ANALYSIS/MARGIN REQUIREMENT
    - AERO HEATING
    - TPS RESPONSE

- TRAJECTORY DISPERSIONS RSS WITH THERMAL UNCERTAINTY
  - SURFACE TEMP MARGIN DUE TO HEATING RATE DISPERSIONS
  - BONDLINE TEMP MARGIN DUE TO HEAT LOAD DISPERSIONS

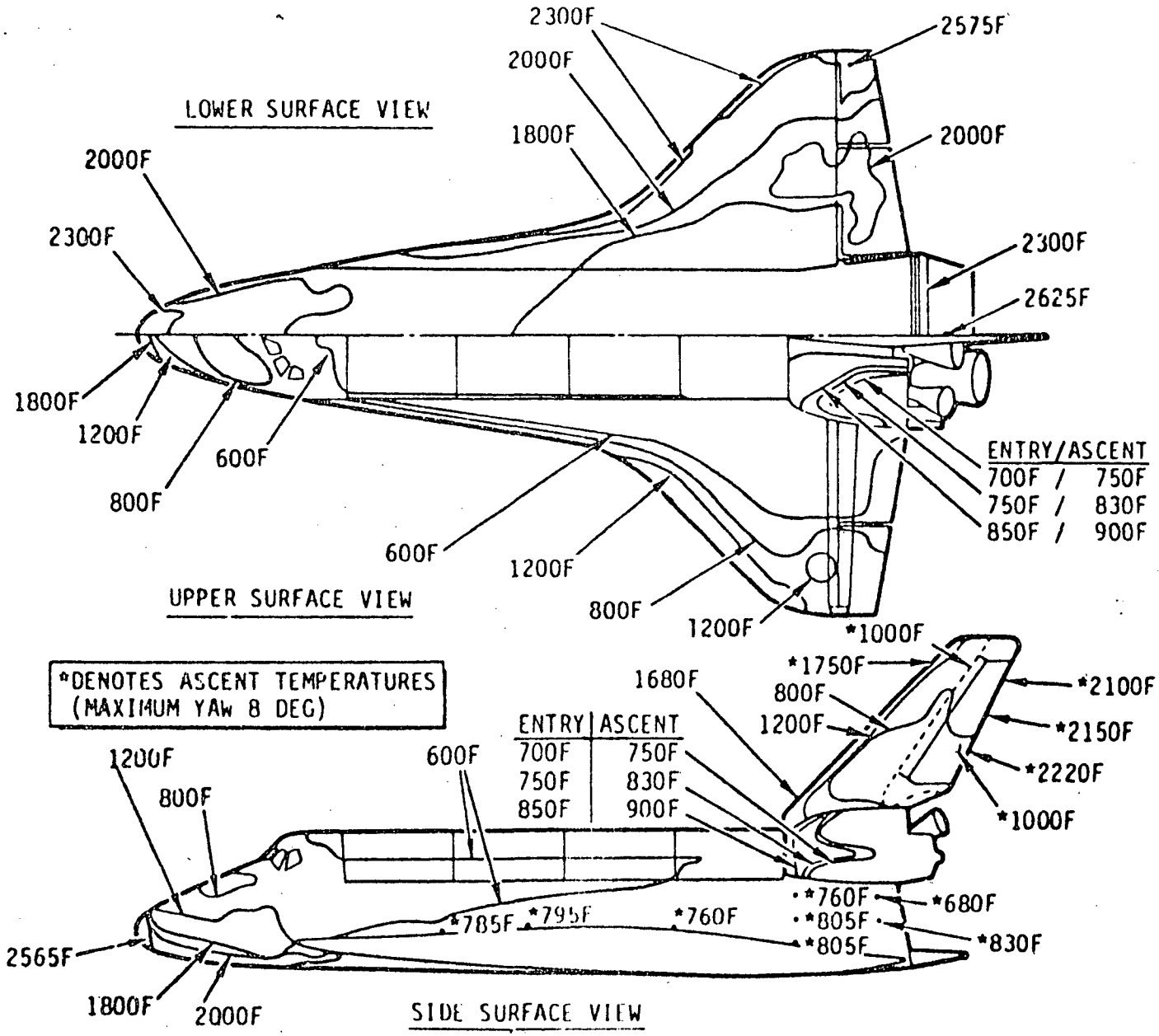
OFT


WING LEADING EDGE
FORWARD CHINE
STS-2
STS-3
STS-1
STS-4
STS-2
STS-3
STS-1
STS-4
1+2
3
4
2950
2850
2750
2650
2550
2450
SURFACE TEMP, °F
50
40
30
27
20
10
0
-10
-20
BONDLINE TEMPERATURE MARGIN, °F

W-34

(OFT)

ORBITER ISOTHERMS - TRAJECTORY 14414.1C



OFT

ENTRY FLIGHT TESTS

AIR DATA SYSTEM

STS-1	STS-2	STS-3	STS-4	POST OFT
O DATA ONLY	O DEPLOY 1 PROBE AT AT M= 5.0*	O DEPLOY BOTH PROBES AT M=5.0*	O DATA ONLY	

* UNDER REVIEW

AUTOLAND

STS-1	STS-2	STS-3	STS-4	POST OFT
O MANUAL APPROACH LAKEBED	O AUTOLAND TO FLARE, MANUAL LAND, LAKEBED	O AUTOLAND THRU ROLLOUT, LAKEBED	O AUTOLAND RHTU ROLL-OUT, RUNWAY	O AUTOLAND TO FLARE, MANUAL LAND, KSC
O DAC PHOTOS	O DAC PHOTOS	O DAC PHOTOS	O DAC PHOTOS	O AUTOLAND THRU ROLLOUT, KSC
				O DAC PHOTOS

CREW ACCOMMODATIONS

STS-1	STS-2	STS-3	STS-4	POST OFT
O NOISE LEVEL DATA	O NOISE LEVEL DATA	O NOISE LEVEL DATA	O NOISE LEVEL DATA	O NOISE LEVEL DATA
				O ANIT-G SUIT EVALUATION

THE POST "OFT" PERIOD

- IT HAS BEEN RECOGNIZED THAT THE TRANSITION FROM DDT&E TO OPERATIONS IS GRADUAL AND THAT SOME TESTING MUST BE CONDUCTED IN THE OPERATIONAL PERIOD.

- FOR THAT REASON THE OV-102 ORBITER WILL REMAIN INSTRUMENTED BEYOND OFT AND OV-099 WILL HAVE A MUCH SMALLER BUTH ADEQUATE INSTRUMENTATION SET. IN EACH CASE A LARGE PERCENTAGE OF THE DATA PROCESSING "BLACK BOX" COMPONENTS CAN BE REMOVED FOR WEIGHT CRITICAL FLIGHTS.

- THE COMPLETION OF VERIFICATION TESTING OR THE TESTING OF NEW CAPABILITIES CAN THUS BE CONDUCTED ON A GENERALLY NON-INTERFERENCE BASIS WITH PAYLOAD.

STS-1 FLIGHT PROFILE

JSC
L. KEYSER
K-1

- OVERVIEW
- NOMINAL ASCENT
- ASCENT ABORT
- ONORBIT
- DESCENT

STS-1 FLIGIIT OVERVIEW

STS-1 OVERVIEW

ONORBIT PROFILE:

ORBIT ALTITUDE	150/150 N. MILES
INCLINATION:	40.3 DEGREES
LAUNCH DATE:	MARCH 10, 1981
GMT OF LAUNCH (FROM KSC):	12:23:00
EST OF LAUNCH:	7:23 A.M.
LAUNCH WINDOW DURATION:	3 HOURS 42 MINUTES
EARLIEST:	LAUNCH LIGHTING REQUIREMENT
LATEST :	SUN-RUNWAY AZIMUTH/ELEVATION CONSTRAINT
MISSION DURATION:	54.5 HOURS
PST OF LANDING (AT EAFB):	10:53 A.M.

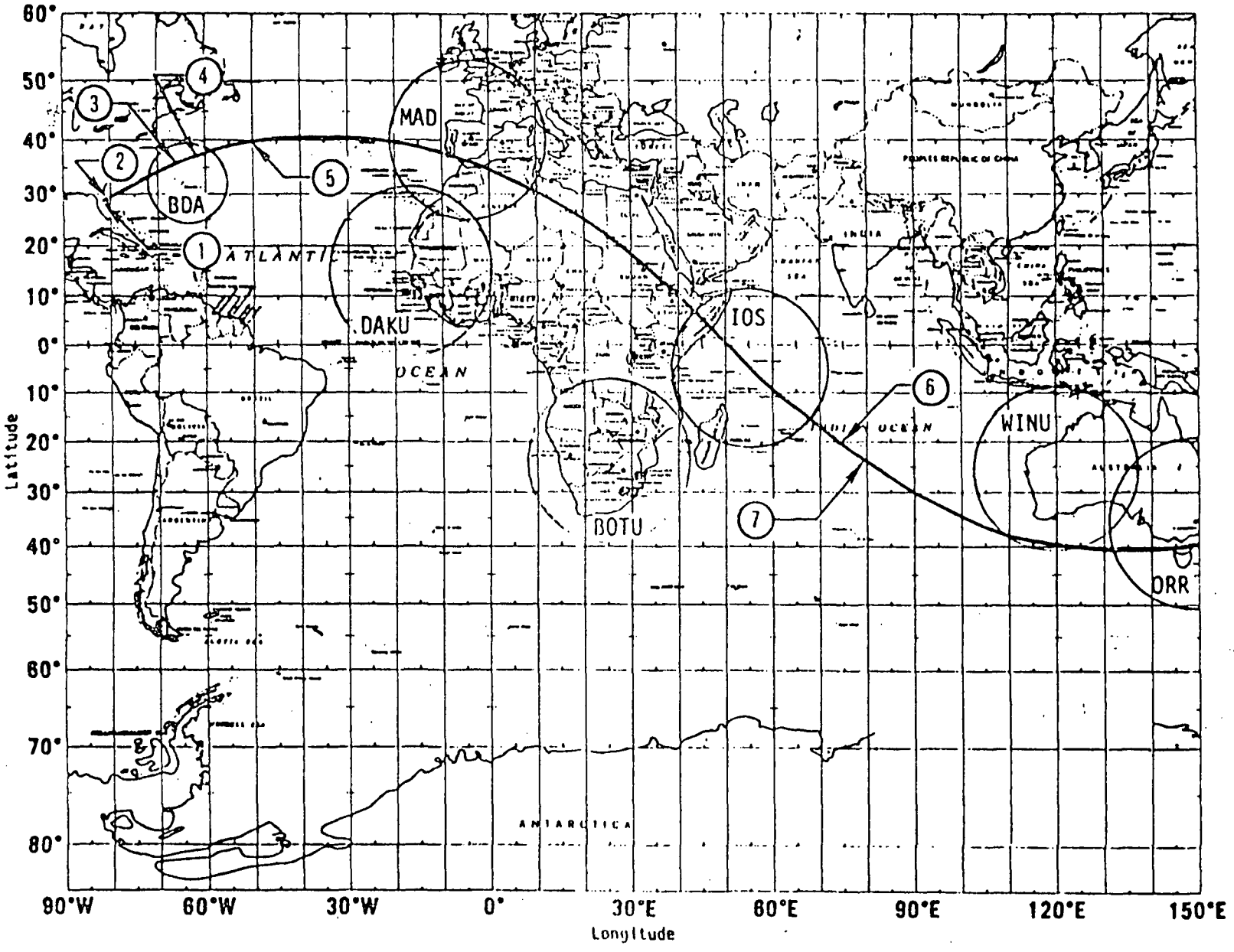
STS-1 FLIGHT
SEQUENCE OF EVENTS

GMT OF STS-1 LAUNCH: MARCH 10, 1981 12:23:00 (7:23 A.M. E.S.T.)
INCLINATION = 40.3
ORBITAL ALTITUDE = 150/150 NAUTICAL MILES

EVENT	MISSION ELASPED TIME, HR:MIN:SEC	COMMENTS
SRB IGNITION	0:00:00	
LIFT-OFF	0:00:00.3	
PITCHOVER	0:00:08	
MAX q	0:00:53	
SRB SEPARATION	0:02:12	
MECO	0:08:32	ORBIT = 13/80
ET SEPARATION	0:08:50	
OMS-1 IGNITION	0:10:32	
OMS-1 CUTOFF	0:12:22	ORBIT = 57/150
OMS-2 IGNITION	0:45:52	
OMS-2 CUTOFF	0:47:22	ORBIT = 150/150
OMS-3 IGNITION	30:59:50	
OMS-3 CUTOFF	31:00:11	ORBIT = 149/150
OMS-4 IGNITION	31:29:50	
OMS-4 CUTOFF	31:30:10	ORBIT = 149/150
DEORBIT IGNITION	53:30:44	
DEORBIT CUTOFF	53:33:19	ORBIT = 2/149
ENTRY INTERFACE	53:58:54	
TAEM	54:24:11	
LANDING	54:30:35	

STS-1 FLIGHT ASCENT

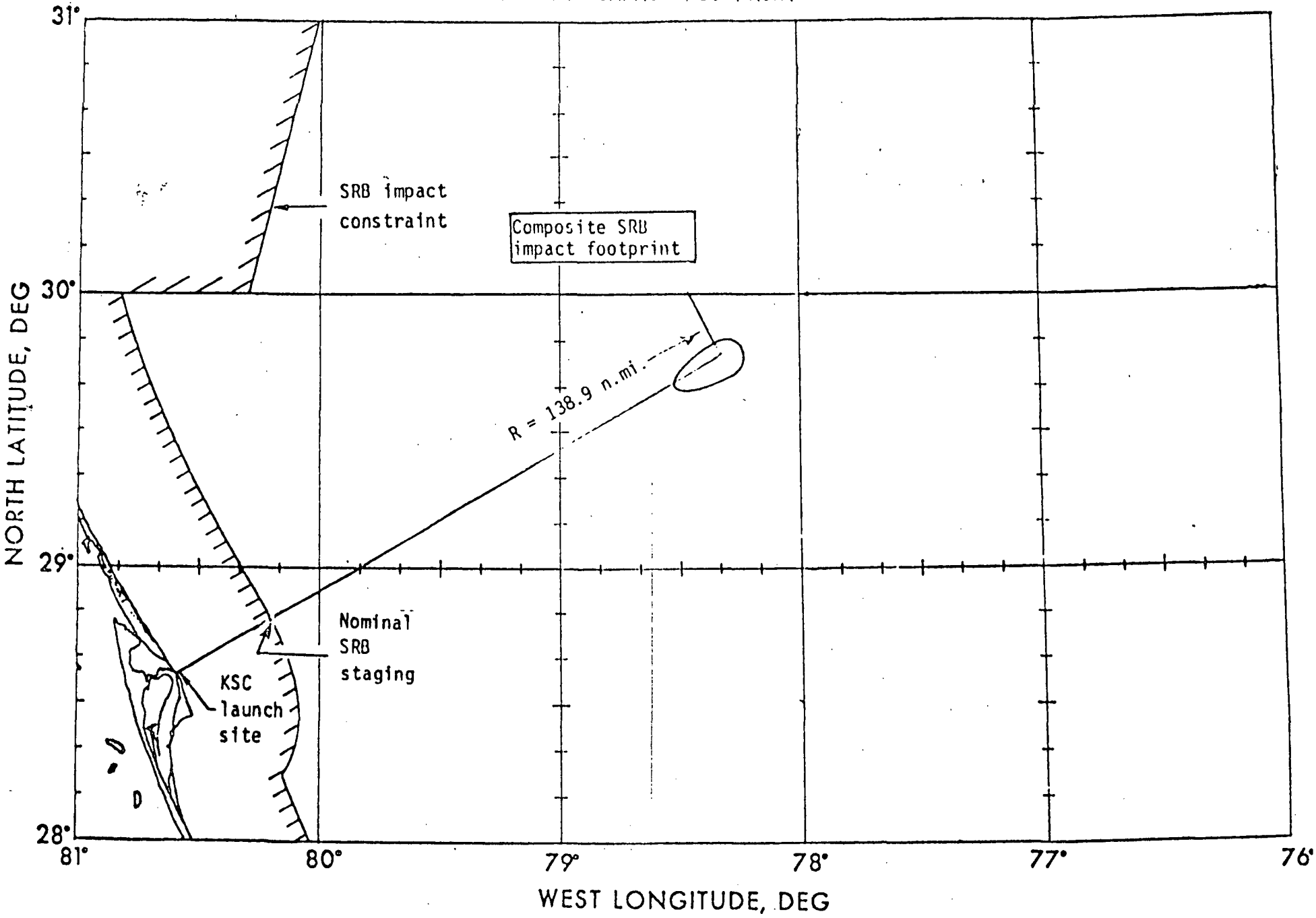
STS-1 ASCENT GROUNDTRACK AND POST-MECO COMMUNICATION COVERAGE



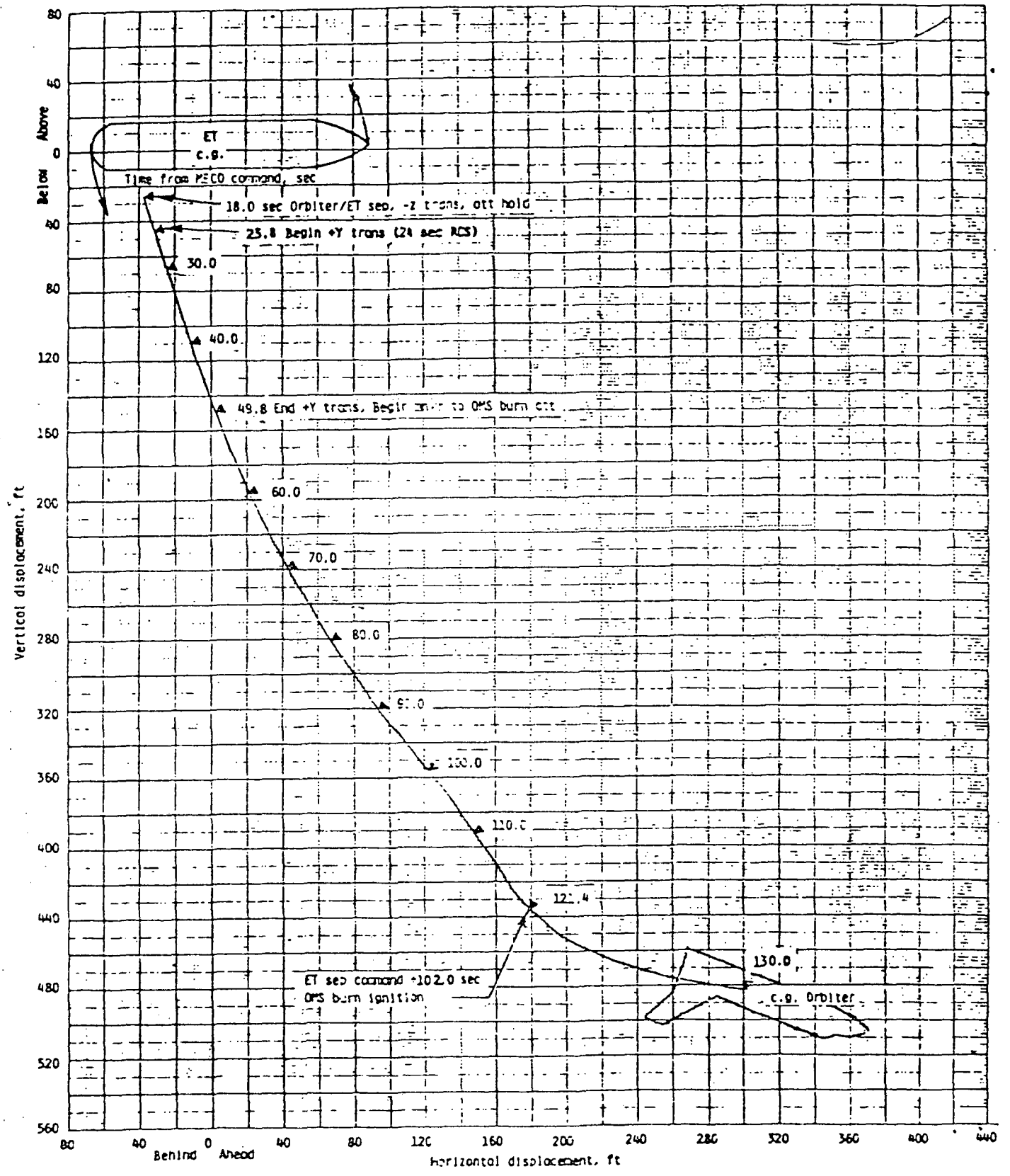
STS-1 ASCENT MAJOR EVENTS

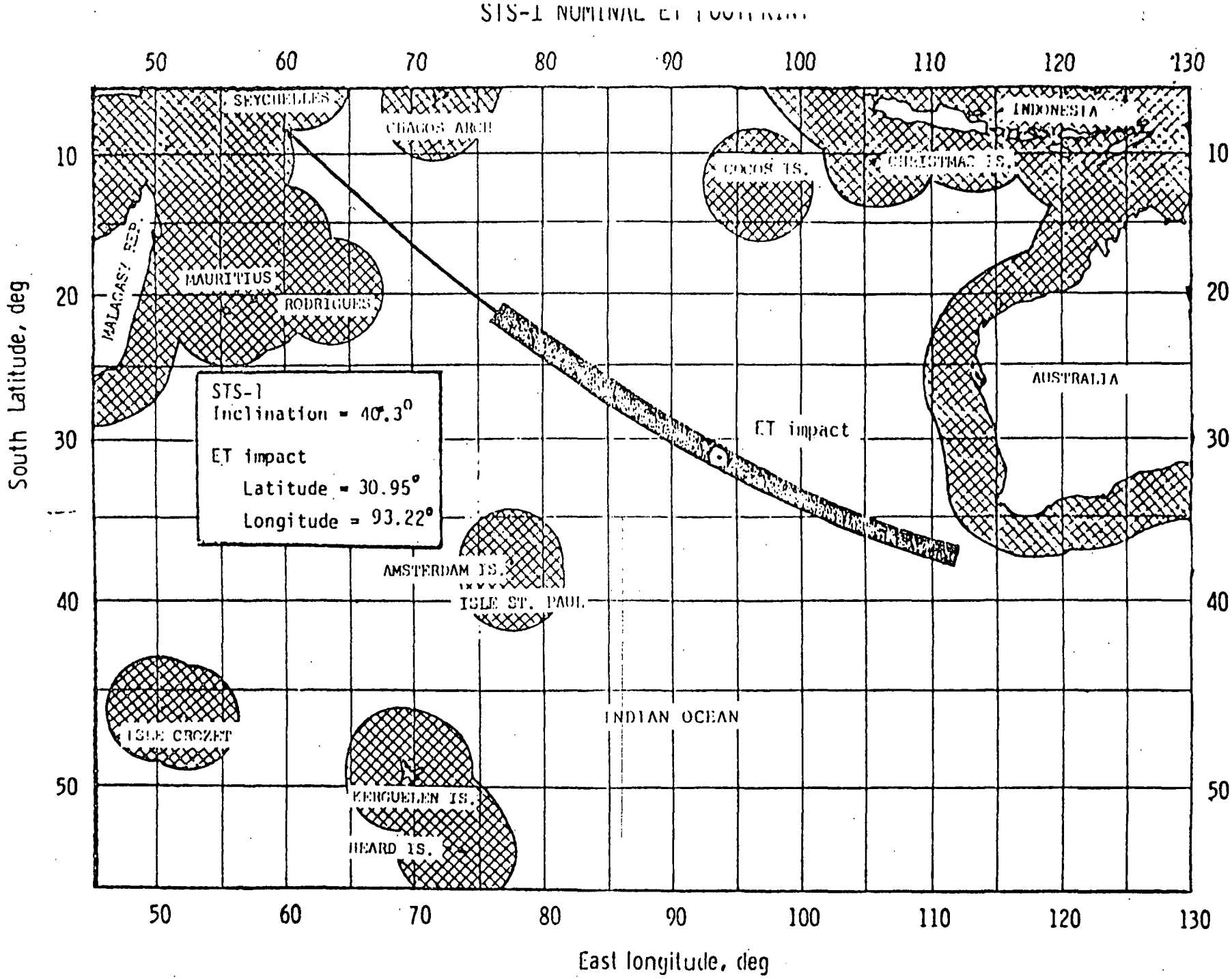
		GET (MIN:SEC)	RANGE (N.MI.)	ALTITUDE/ORBIT (N.MI.)
	LIFTOFF	0:00	0.	0.
	THROTTLE FOR DYN PRESSURE	0:34	.4	1.7
1	MAX. DYN PRESSURE	0:53	1.7	4.4
2	SRB SEPARATION	2:12	21.	27.
3	MECO (ET SEP)	8:32	740.	13/80
4	OMS-1 IGNITION	10:32	---	
5	OMS-1 CUTOFF	12:22	---	57/150
6	OMS-2 IGNITION	45:52	---	
7	OMS-2 CUTOFF	47:22	---	150/150

STS-1 SRB IMPACT FOOTPRINT



NOMINAL ORBITER/ET RELATIVE MOTION FOR THE SEPARATION MANEUVER
VERTICAL AND HORIZONTAL DISPLACEMENT




STS-1 NOMINAL ET FOOTPRINT
50
60
70
80
90
100
110
120
130
10
20
30
40
50
SEYCHELLES
CHAGOS ARCH
COCOS IS.
INDONESIA
CHRISTMAS IS.
MALAGASY REP.
MAURITIUS
RODRIGUES
AUSTRALIA
STS-1
Inclination = 40.3°
ET impact
Latitude = 30.95°
Longitude = 93.22°
ET impact
AMSTERDAM IS.
ISLE ST. PAUL
INDIAN OCEAN
ISLE CROZET
KERGUELEN IS.
HEARD IS.
South Latitude, deg
East longitude, deg

STS-1 FLIGHT ASCENT ABORTS

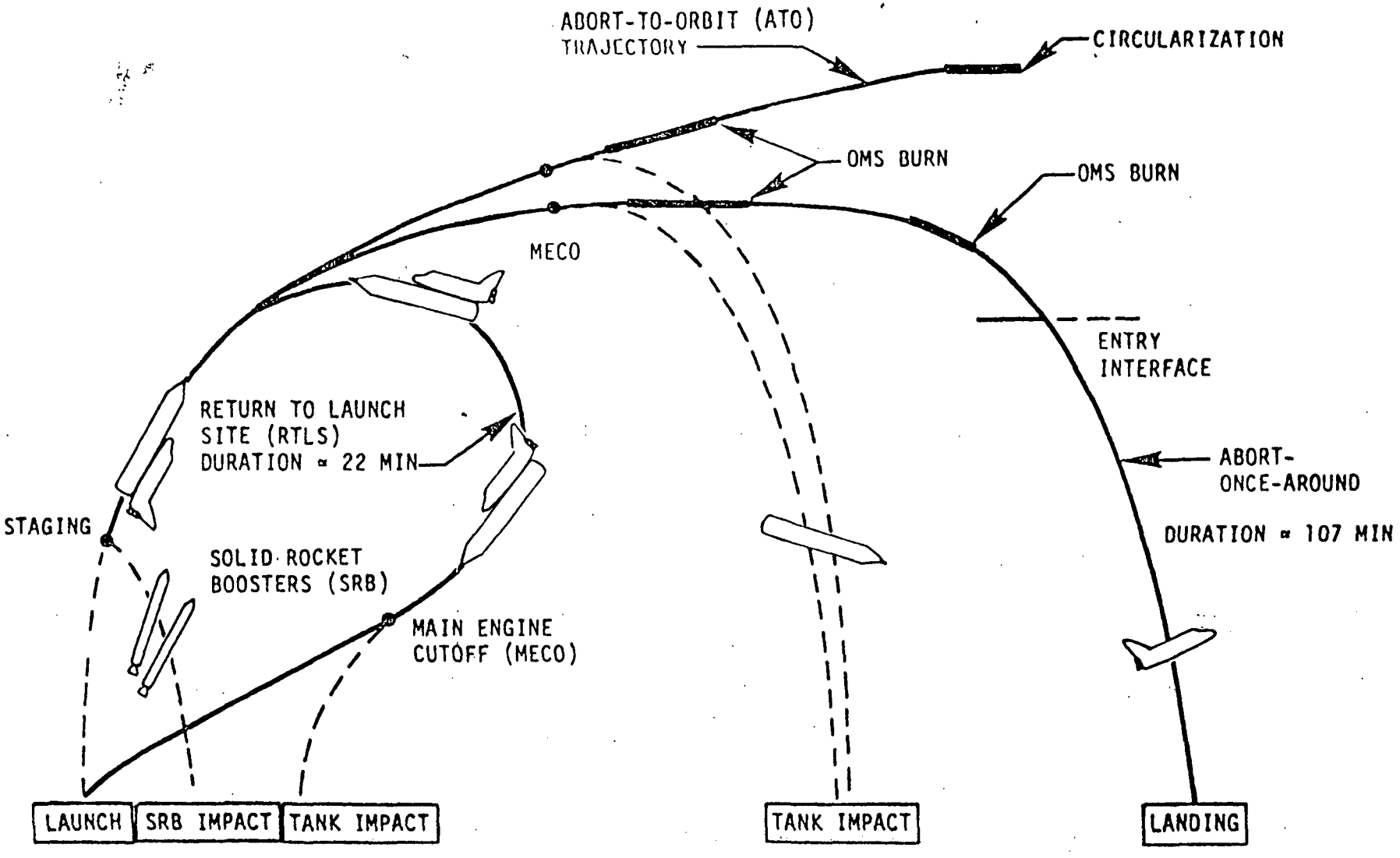
ASCENT ABORTS

INTACT ABORT CAPABILITY PROVIDES A ROUTE FOR SAFE RETURN OF THE CREW, ORBITER, AND PAYLOAD TO A PLANNED LANDING SITE. THE PRIMARY REQUIREMENT FOR AN INTACT ABORT CAPABILITY IS TO PROVIDE PROTECTION AGAINST THE LOSS OF A SINGLE SPACE SHUTTLE MAIN ENGINE (SSME) OR A SINGLE ORBITAL MANEUVERING SYSTEM (OMS) ENGINE.

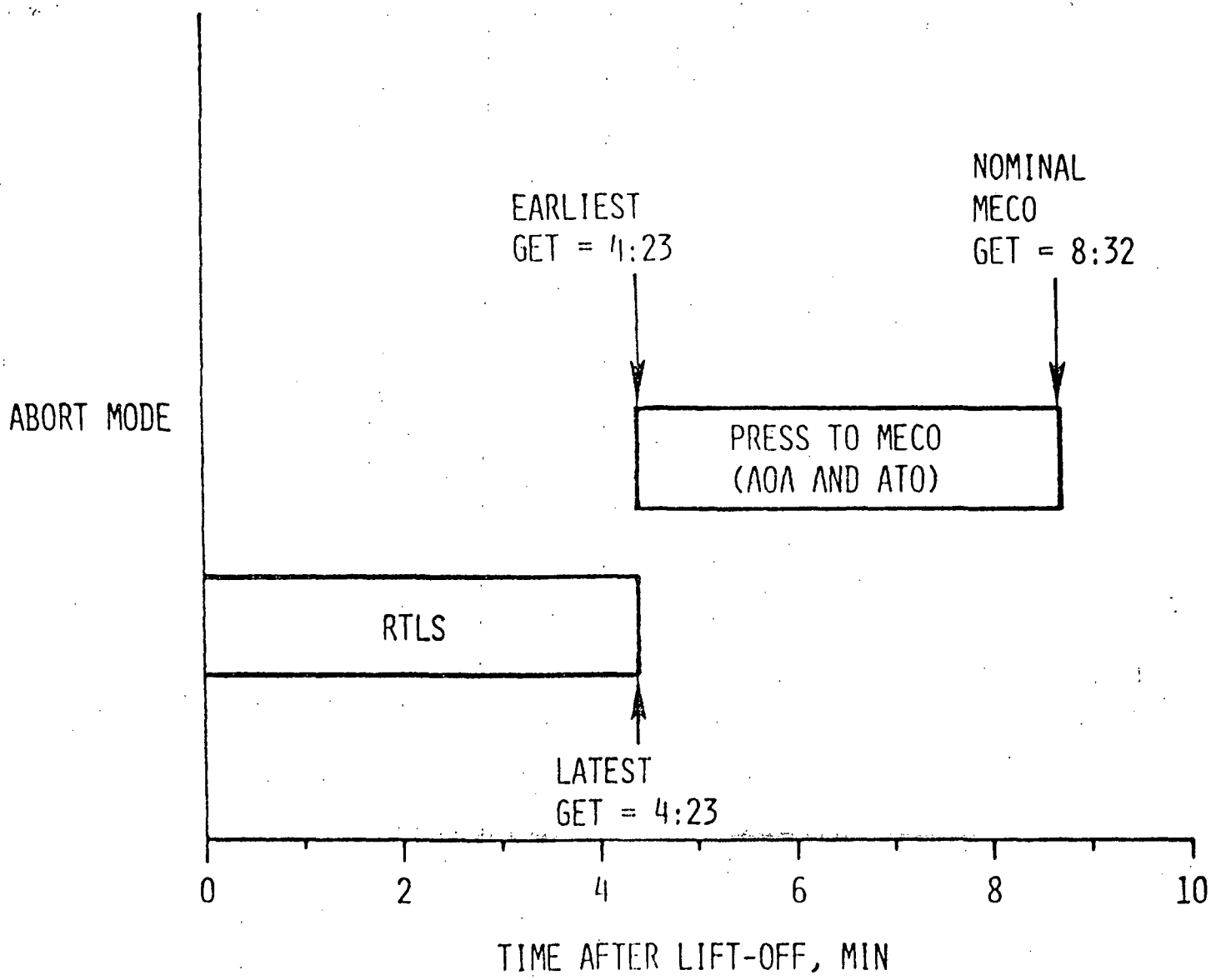
INTACT ABORT MODES

- RETURN TO LAUNCH SITE (RTLS)
- PRESS TO MAIN ENGINE CUTOFF (MECO)
  - ABORT ONCE AROUND (AOA)
  - ABORT TO ORBIT (ATO)

TYPES OF INTACT ABORTS



STS-1
ASCENT ABORT CAPABILITY

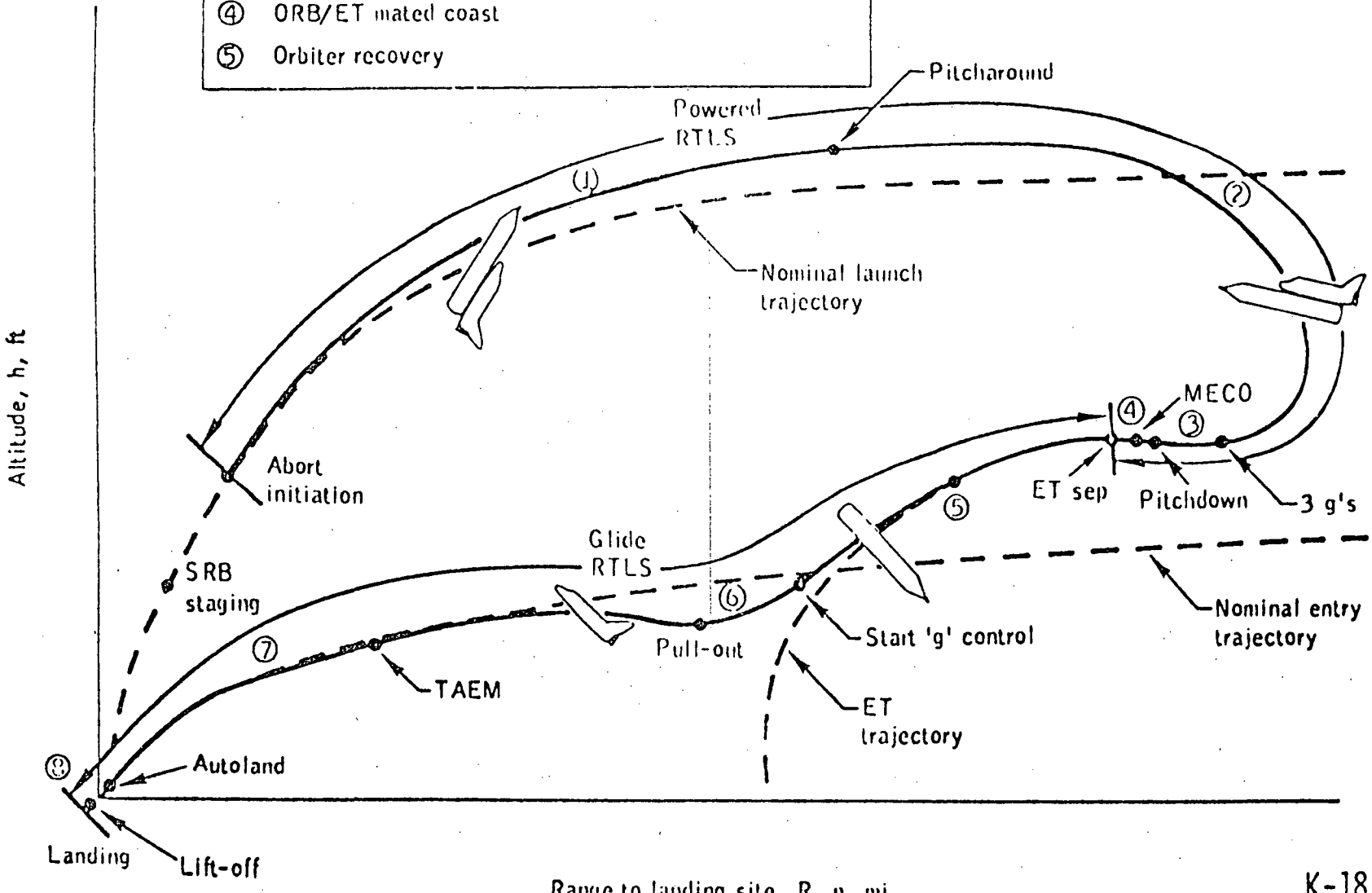


RTLS

- Powered Return to Launch Site (PRTLS) - Portion of RTLS in Which SSME's Are Burning
- Glide Return to Launch Site (GRTLS) - Portion of RTLS in Which the Orbiter Glides to Landing at KSC
- Required for:
  - Single SSME Failure Prior to Press to MECO (AOA or ATO) Capability
  - Time Critical Failures that Require Immediate Return to Launch Site

TYPICAL RTLS PROFILE

RTLS abort flight phases	
① Propellant dissipation	⑥ Load relief
② PWD FLT guidance	⑦ TAEM guidance
③ Powered pitchdown (PPD)	⑧ Autoland
④ ORB/ET mated coast	
⑤ Orbiter recovery	



ABORT ONCE AROUND (AOA)

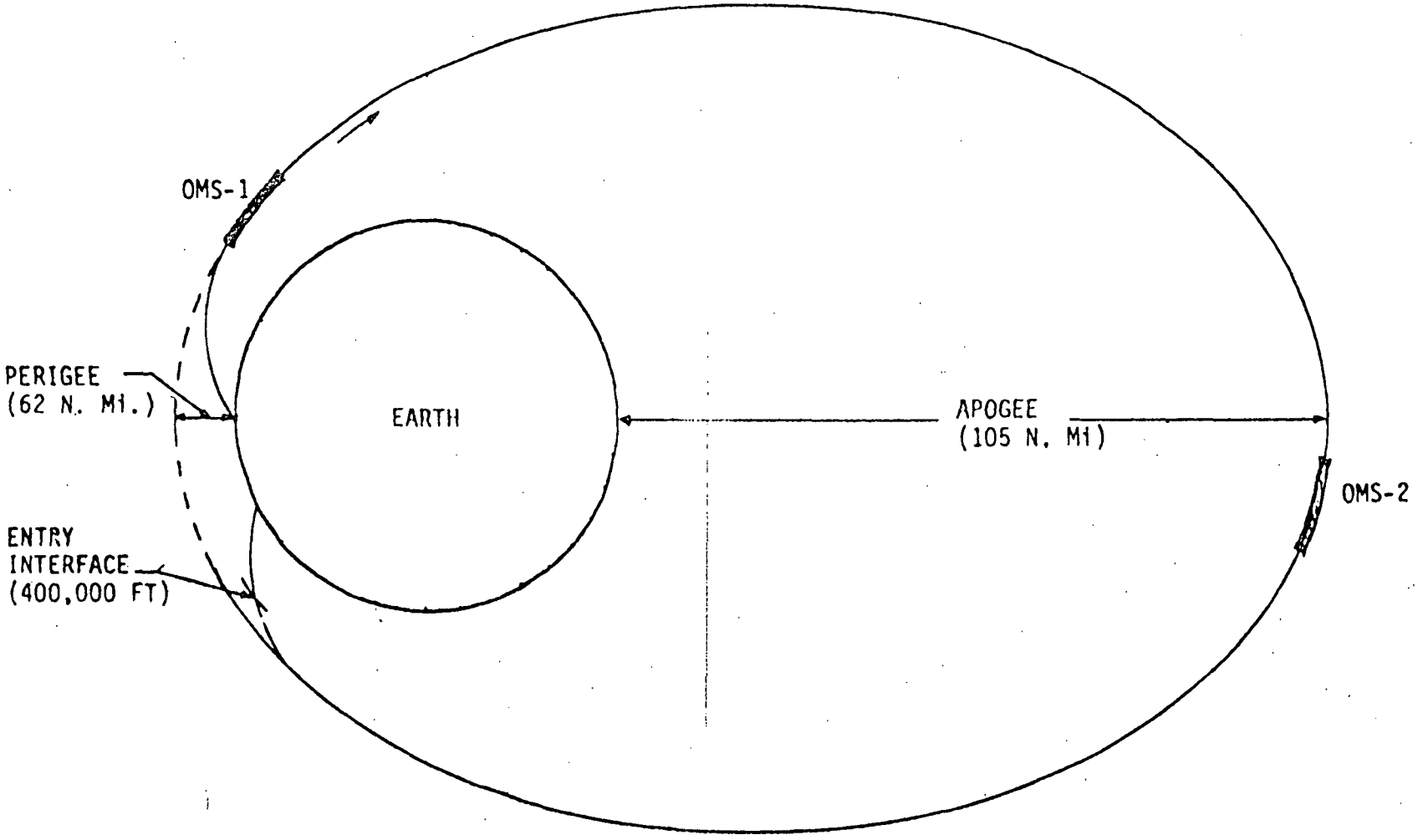
- ADEQUATE ENERGY (SSME AND OMS) FOR ORBITER TO FLY AT LEAST ONE REVOLUTION AND THEN DEORBIT TO LAND AT NORTHRUP STRIP, N.M.
- 2 OMS MANEUVERS

  OMS-1 (OPTIMIZES ORBITAL CONDITIONS FOR OMS-2)

  OMS-2 (DEORBIT MANEUVER - PROVIDES DESIRED ENTRY CONDITIONS)

- REQUIRED FOR
  - SINGLE SSME FAILURE PRIOR TO ACCEPTABLE ORBIT CAPABILITY
  - TIME CRITICAL FAILURES REQUIRING IMMEDIATE RETURN (AFTER RTLS CAPABILITY ENDS)

STS-1
AOA POST-MECO GEOMETRY



ABORT TO ORBIT (ATO)

- ADEQUATE ENERGY (SSME AND OMS) FOR ORBITER TO ACHIEVE 105 N.MI. CIRCULAR ORBIT (AND DEORBIT) BUT INSUFFICIENT ENERGY (SSME AND OMS) TO ACHIEVE NOMINAL 150 N.MI. CIRCULAR ORBIT.

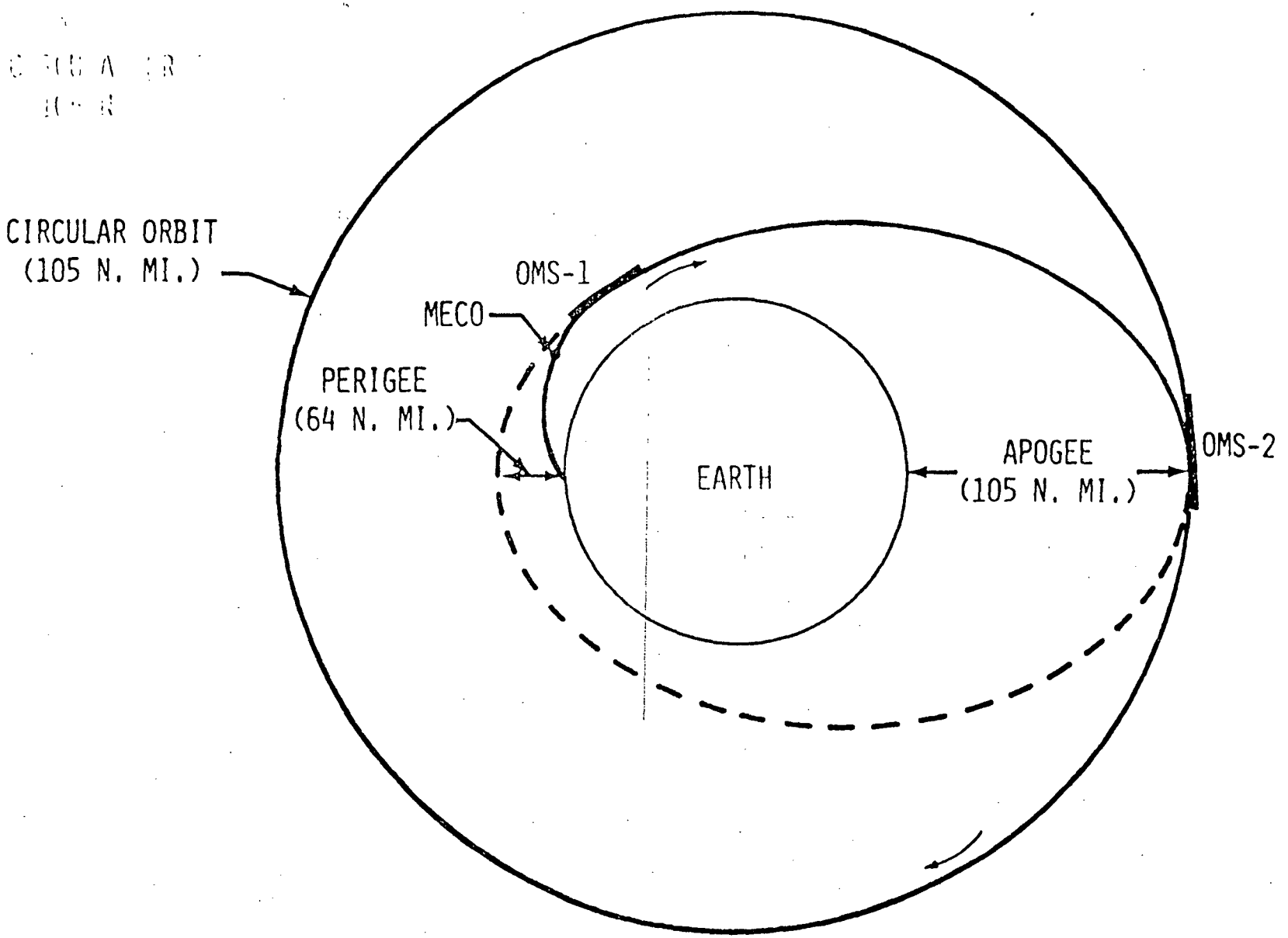
- SIMILAR TO NOMINAL MISSION

  OMS-1: RAISES APOGEE TO 105 N.MI.

  OMS-2: CIRCULARIZES ORBIT TO 105 N.MI.

- REQUIRED WHEN SINGLE SSME FAILURE PRIOR TO CAPABILITY TO ACHIEVE NOMINAL ORBIT (150 N.MI. CIRCULAR)

STS-1
ATO POST-MECO GEOMETRY

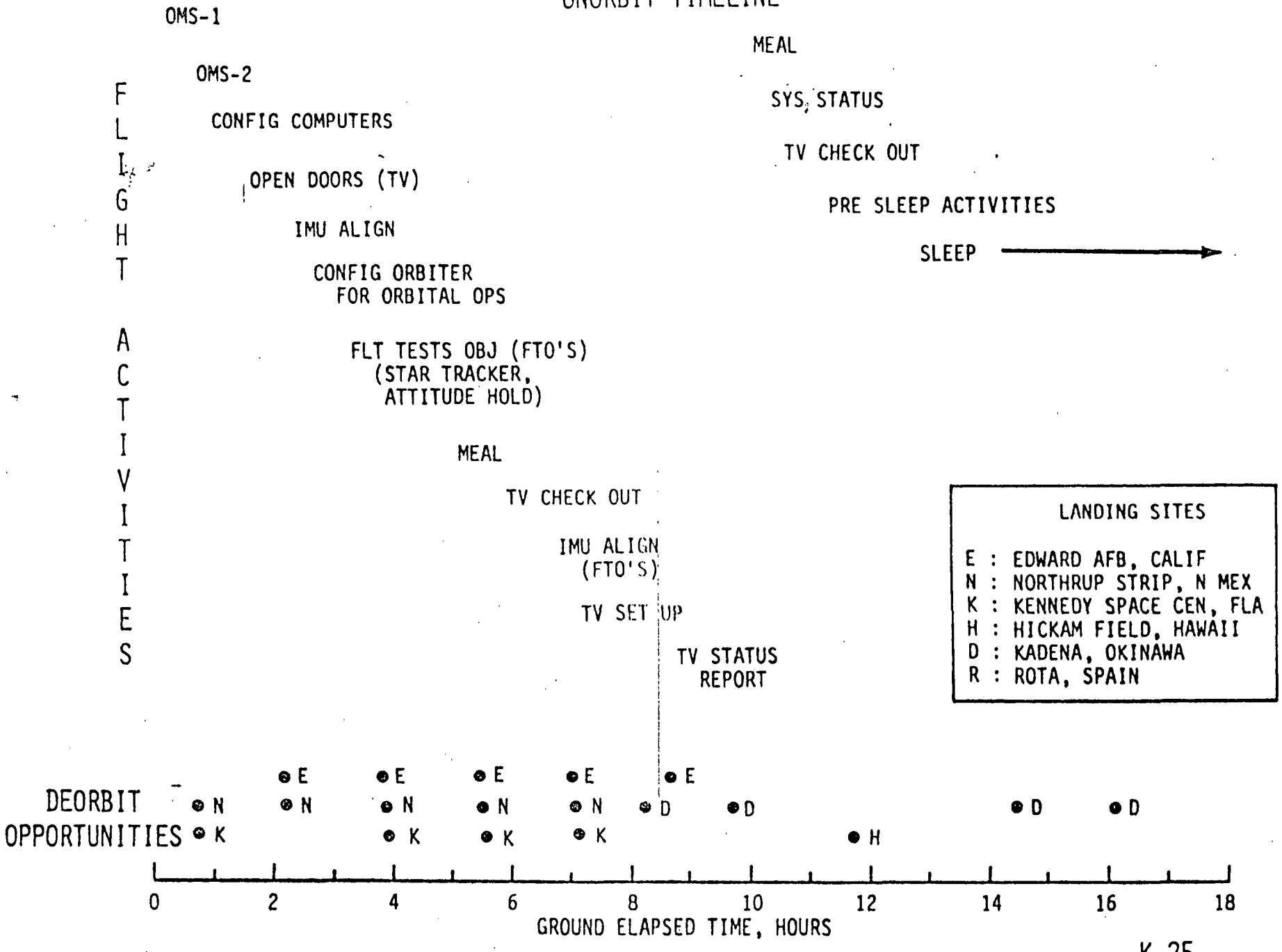


CONTINGENCY ABORT MODES

- EJECTION
- DITCHING

STS-1 FLIGHT ONORBIT

SIS-1
ONORBIT TIMELINE



STS-1
ONORBIT TIMELINE
(CONTINUED)

FLIGHT ACTIVITIES

SLEEP →

POST SLEEP ACTIVITIES

IMU ALIGN

MEAL

CONFIG FLT CONTROL SYS

[BEGIN DEORBIT REHEARSAL]

RECONF COMPUTERS

CABIN TV

FLT CONTROL SYS CHECK OUT

RECONF COMPUTERS

DEACTIVATE SYS

SUIT DONNING

RECONF COMPUTERS

SNACK

CLOSE PAYLOAD BAY DOORS

IMU ALIGN

SEAT INGRESS

MANEUVER PREP

[END DEORBIT REHEARSAL]

SEAT EGRESS

OPEN PAYLOAD BAY DOORS

RECONF COMPUTERS

SUIT DOFFING

SYSTEM ACTIVATION

OMS-3 MANEUVER

OMS-4 MANEUVER

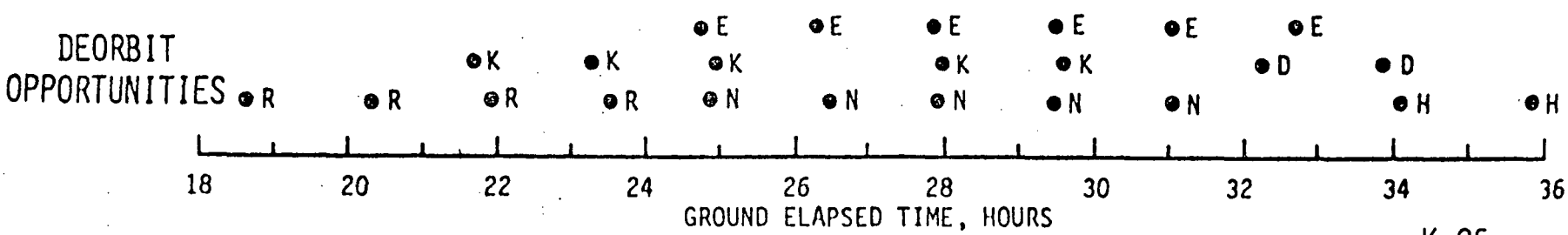
RECONF COMPUTERS

FLT TEST OBJECTIVES

MEAL

TV (MIDDECK)

IMU ALIGN



STS-1
ONORBIT TIMELINE
(CONCLUDED)

FLIGHT ACTIVITIES

PRE SLEEP

SLEEP

POST SLEEP

IMU ALIGN

RCS TEST (FTO)

MEAL

RECONF COMPUTER

FLT CONT SYS CHECK OUT

RECONF COMPUTER

CREW SYS DEACTIVATION

SUIT DONNING

RECONF COMPUTER

SNACK

CLOSE PAYLOAD BAY DOORS

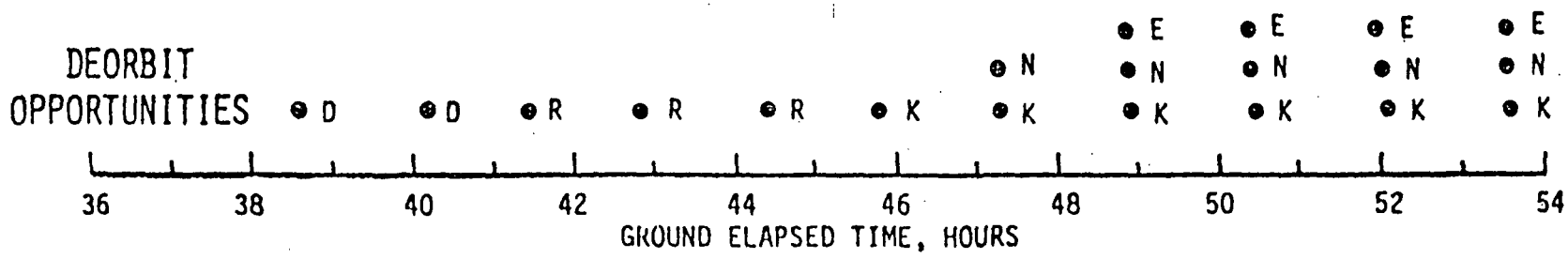
IMU ALIGN

SEAT INGRESS

MANEUVER PREP

[DEORBIT = 53:31]

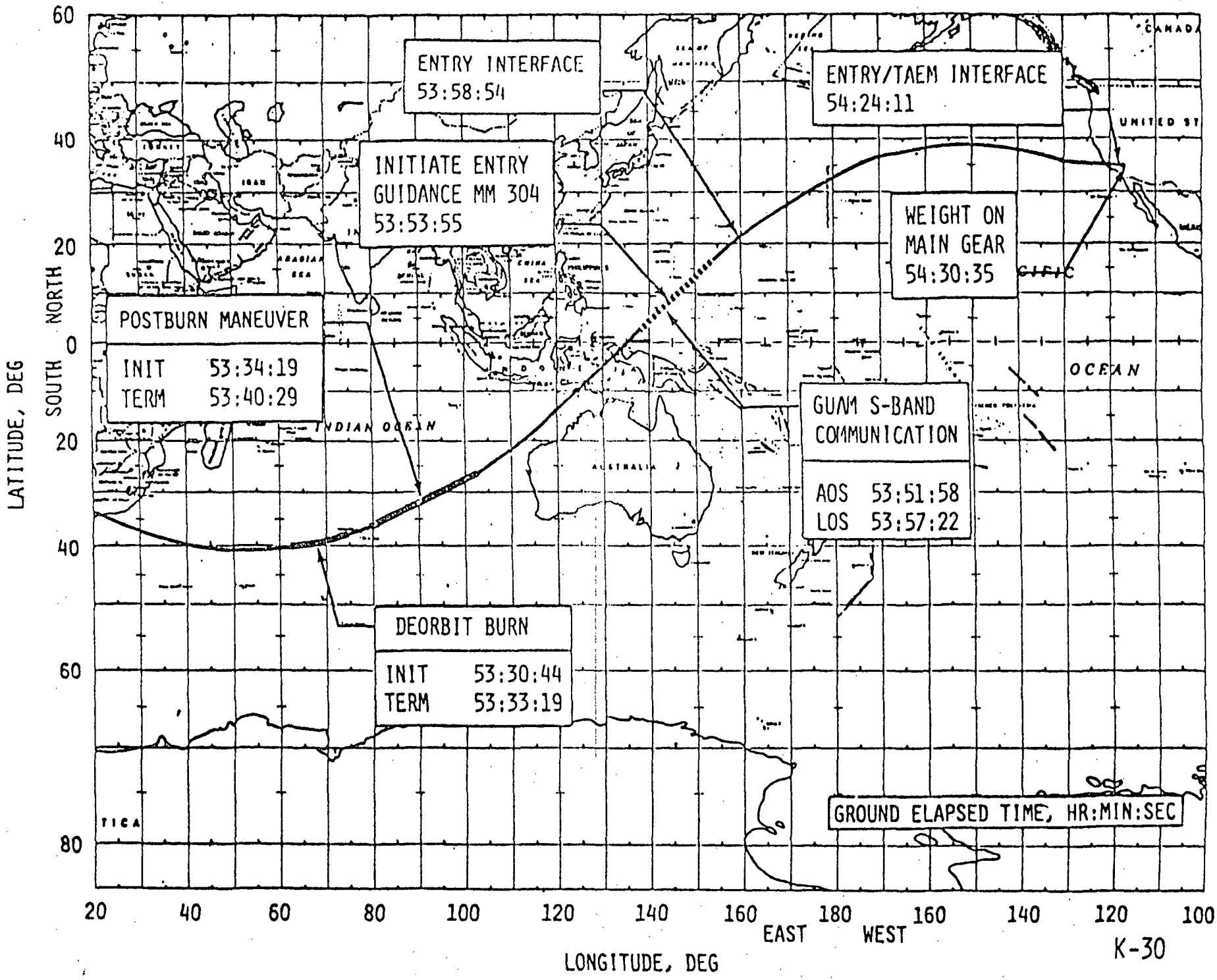
[LANDING = 54:31]



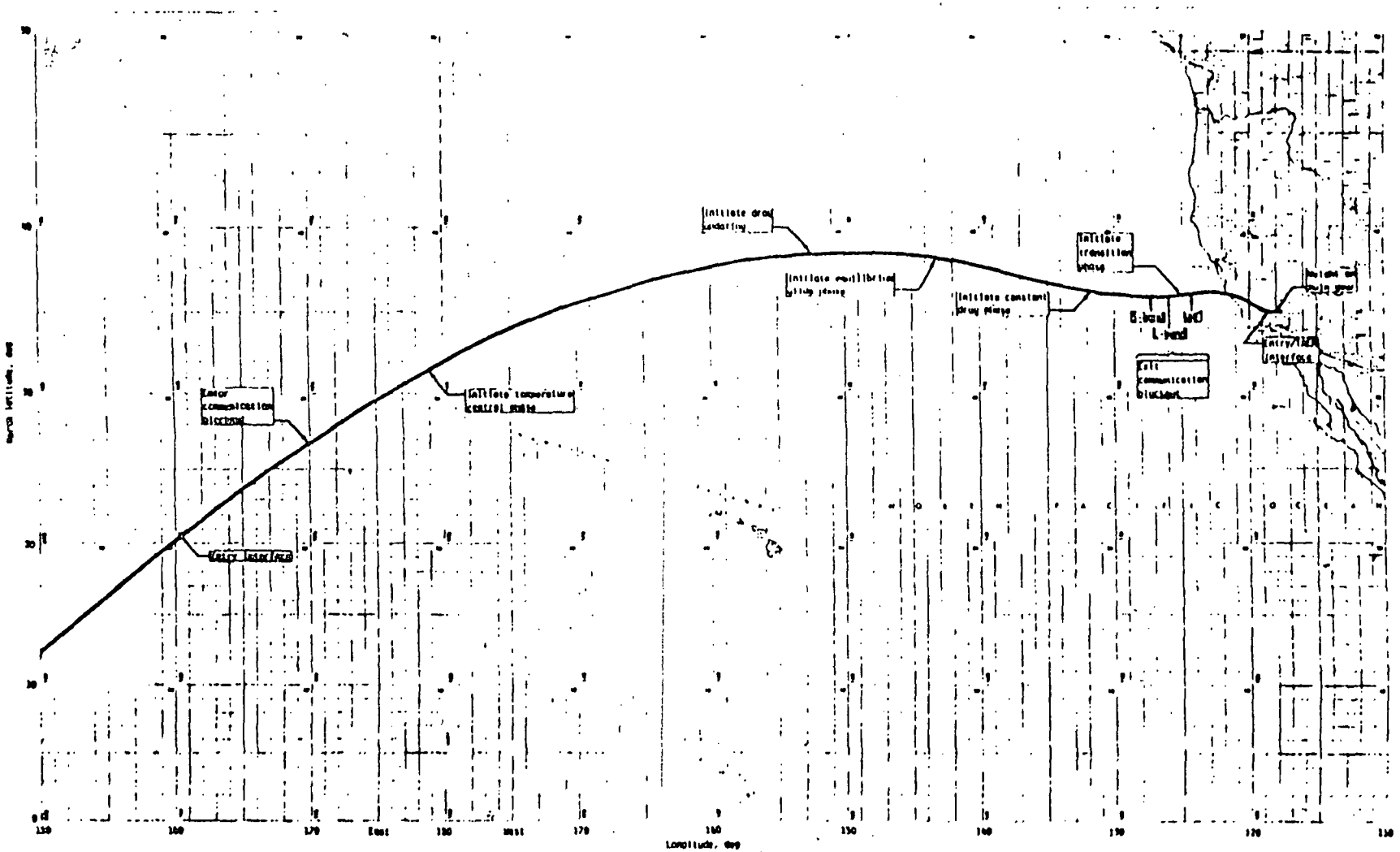
STS-1 FLIGHT DESCENT

DESCENT

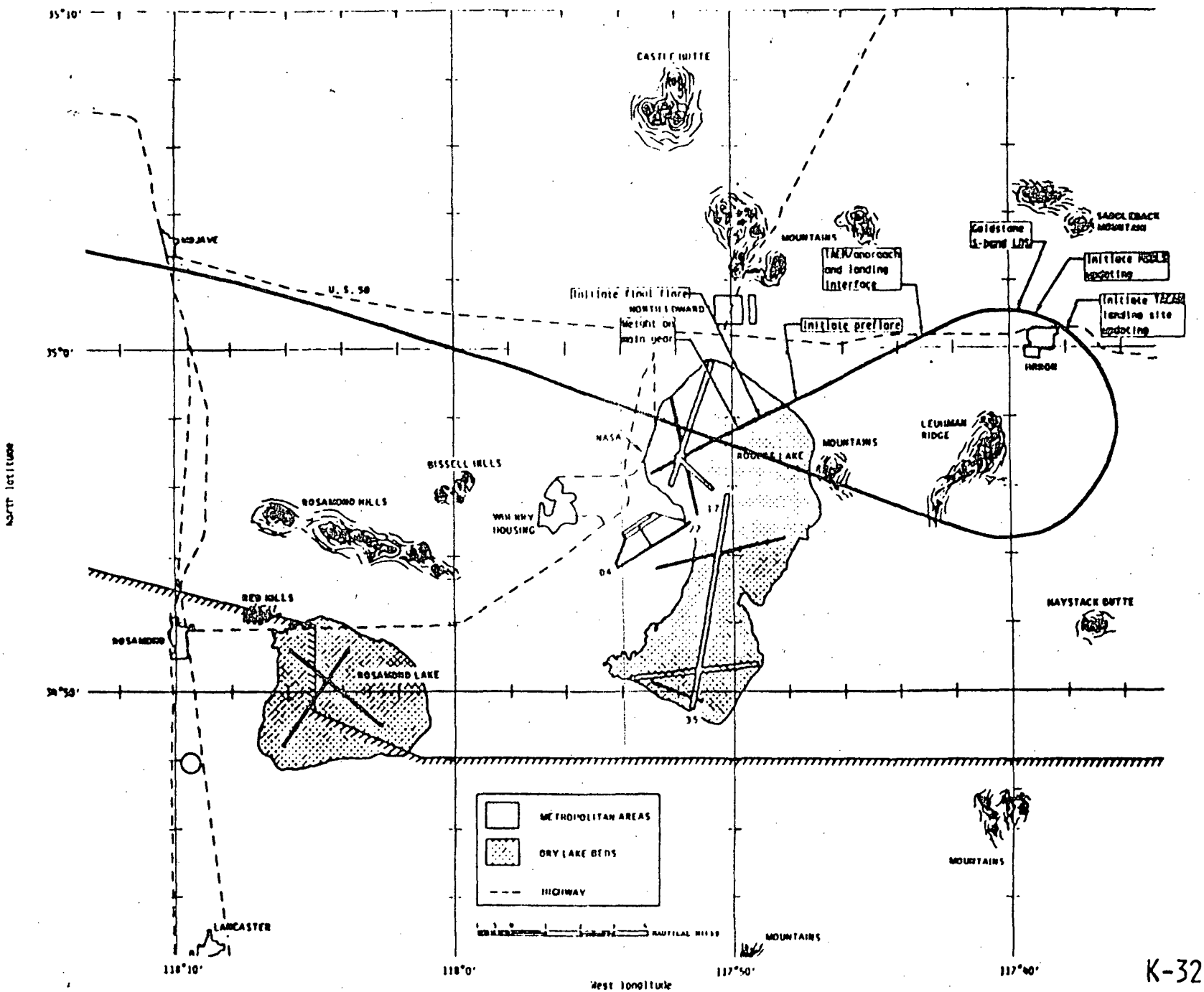
- DEORBIT
- ENTRY
- TERMINAL AREA ENERGY MANAGEMENT (TAEM)
- APPROACH AND LANDING


ENTRY INTERFACE
53:58:54
ENTRY/TAEM INTERFACE
54:24:11
INITIATE ENTRY
GUIDANCE MM 304
53:53:55
WEIGHT ON
MAIN GEAR
54:30:35
POSTBURN MANEUVER
INIT 53:34:19
TERM 53:40:29
GUAM S-BAND
COMMUNICATION
AOS 53:51:58
LOS 53:57:22
DEORBIT BURN
INIT 53:30:44
TERM 53:33:19
GROUND ELAPSED TIME, HR:MIN:SEC
LATITUDE, DEG
SOUTH
NORTH
60
40
20
0
20
40
60
80
20
40
60
80
100
120
140
160
180
160
140
120
100
EAST
WEST
LONGITUDE, DEG
INDIAN OCEAN
OCEAN
AUSTRALIA
CANADA
UNITED ST

STS-1 ENTRY INTERFACE THROUGH LANDING GROUNDTRACK



STS-1 APPROACH AND LANDING GROUNDTRACK



K-32

NASA News

National Aeronautics and
Space Administration

Washington, D C. 20546
AC 202 755-8370

For Release:

SPACE SHUTTLE STATUS REPORT

Wednesday, November 5, 1980

Orbiter:

The orbiter was powered up on Monday morning. Auxiliary power units 1, 2 and 3 have been reinstalled and retesting is now underway. All 12 bolts attaching each of the orbital maneuvering system pods to the orbiter structure have been installed and torqued for flight. The external tank aft umbilical doors on the bottom of the wing have been installed and are now undergoing testing. Preparations are underway to reinstall the Space Shuttle main engines on November 8-9.

Tiles:

The number of thermal protection system tiles now on the vehicle is 30,116 with 645 cavities remaining. The estimated number of bonds to completion is 1,269. During the week ending November 2, 476 tiles were bonded and 73 removed for a net gain of 403. During that week, 598 tile proof tests were conducted with 587 accepted and 11 rejected.

-more-

External Tank/Solid Rocket Boosters:

Mating of the external tank and the twin solid rocket boosters on a mobile launcher platform in High Bay 3 of the Vehicle Assembly Building began on Monday and was virtually complete by early Tuesday afternoon. Pull tests are pretensioning of the attachment struts to compensate for the shrinkage of the external tank when it is loaded with supercold propellants will be accomplished following the completion of mating operations.

Recovery Operations:

Sea trials of the UTC Liberty, first of two specially built vessels designed for solid rocket booster retrieval, are scheduled to begin Wednesday afternoon, November 5.

Complex 39, Pad A:

The orbital maneuvering system pod covers for the heated pod purge system on the rotating service structure were delivered to the pad on Friday and installed on the rotating service structure over the weekend. Installation was completed on Monday. Prooftesting of the payload ground handling mechanism (PGHM) on the rotating service structure is scheduled to begin on Thursday.

Payloads:

The Office of Space and Terrestrial Applications (OSTA)-1 payload, scheduled for flight on STS-2, is to be moved from the Apollo Telescope Mount (ATM) Clean Room in the Operations and Checkout Building High Bay and installed in a CITE (Cargo Integration Test Equipment) workstand. Experiments will be integrated with the OSTA-1 pallet beginning about November 12. Five of OSTA-1's seven experiments are mounted on the pallet; the other two ride in the orbiter's cabin. Integrated CITE testing of the OSTA-1 payload is to begin March 2.

-end-